Sparc's Willow Reserve Project

Prepared by
Elizabeth Turner
Research Assistant, University of Minnesota
Conducted on behalf of
Sparc
December, 2009

This report (NPCR 1290) is also available on the CURA website:
www.cura.umn.edu/search/index.php

December, 2009

Neighborhood Partnerships for Community Research (NPCR) supported the work of the author of this work, but has not reviewed it for publication. The content is solely the responsibility of the author and is not necessarily endorsed by NPCR.

NPCR is coordinated by the Center for Urban and Regional Affairs at the University of Minnesota. NPCR is supported by the McKnight Foundation.

Neighborhood Partnerships for Community Research
330 Hubert H. Humphrey Center
301 - 19th Avenue South
Minneapolis, MN 55455
phone: 612/625-1020
e-mail: ksn@umn.edu
website: http://www.npcr.org

ELIZABETH TURNER, SUMMER 2009

This project was supported by Neighborhood Planning for Community Revitalization (NPCR), a program of the University of Minnesota's Center for Urban and Regional Affairs (CURA). The contents of this report are the sole responsibility of the author, and are not necessarily endorsed by the University of Minnesota, CURA, or NPCR.

Sparc's Willow Reserve Project

Precedent study for sustainable housing and community development

Elizabeth Turner

Ecologically-conscious communities are important for stepping into a new cultural paradigm and living as if the Earth mattered. Ecovillages are one way to design communities with the Earth in mind. In an ecovillage, residents take responsibility for their own energy sources, food, and general well-being. Most ecovillages are small-scale, self-sustaining communities aimed at developing alternative ecological, environmental, and cultural standards. While rural ecovillages have sprung up across the world with success, urban ecovillages are a new concept that we must consider, especially because the human population threatens to destroy many of our natural areas already (Reidel, 2008).

CONTENTS

INTRODUCTION

The Willow Reserve Project location is a 3-acre piece of land owned by Sparc on the NE corner of Maryland and Arundel in St. Paul. Sparc purchased the land in 2005 and hopes to develop it sometime in the next five years. Sparc decided to purchase the land as the availability to purchase a site of this caliber in older neighborhoods is very rare. Furthermore, Sparc wanted to ensure the neighborhood had input into the final development. The Willow Reserve is located at the North end of the property, a government-owned nature preserve which is heavily wooded and contains a marshy pond and wetlands. That land was purchased decades ago to provide a resting area for migratory birds. As well, the wetlands function as an overflow spot for the Trout Brook storm water management system. The land is owned by City of St. Paul (Public Works), but many different organizations have a stake in any future use of that land, including, but not limited to, the aforementioned Public Works, the Capital Region Watershed District, and the City of St. Paul Department of Parks and Recreation.

Sparc's lot slopes up from this area to meet the road and has several large trees. It was formerly the home of a greenhouse and single family home which were demolished in 2008, leaving the property clear of unnatural obstructions except for one utility pole. There are no known pollutants in the soil, and some perennials such as rhubarb still thrive on the property.

In 2006-7 Sparc developed plans to build 32 townhouse units on the site. However, due to the declining market, they were unable to secure funding. Intrigued by Alchemy Architects' weeHouse and use of prefabrication, in 2008 they began conversations about working on a potential development with the firm and Alchemy produced some rough massing plans showing possible arrangements of units. Sparc began to dream of creating an "urban ecovillage" which could be sustainably designed, include green mixed-use development, and possibly use prefabricated technology which could be replicated throughout the neighborhood. In Summer 2009, they hired a Research Assistant to explore these possibilities through the University of Minnesota's Center for Urban and Regional Affairs—Neighborhood Partnership for Community Research (CURA NPCR). This paper is the result of that collaboration.

EXECUTIVE SUMMARY

This paper explores types of development that would be most sustainable for Sparc's Willow Reserve property, in the full economic, environmental, and social definition of the word. The concept of the Urban Ecovillage is explored in depth, and successful examples in Los Angeles, Cincinnati, and Minneapolis are profiled. An **Urban Ecovillage** is defined as a *community of residents with a common fervor for ecological living working towards existing in a way that is socially, economically, and environmentally sustainable*. This philosophy can take a wide variety of forms, although there are many commonalities. Ecovillages usually employ techniques of permaculture and co-housing and often have a gardening component. While the first ecovillages were in rural areas, a growing number can be found in cities, where they can serve as a catalyst for sustainable development in their urban surroundings.

The Willow Reserve location shows **promise for a thriving urban ecovillage** site for several reasons:

- access to public transportation
- location in a low-to-mid-income community
- close to employment centers
- near nature reserve
- good urban visibility but not too busy

Challenges towards development of a true ecovillage at the site include:

- finding residents willing to commit themselves to the ecovillage philosophy
- finding the "glue" that holds the community together
- establishing it as a landmark in harmony with the existing neighborhood (people and buildings)
- developing economic sustainability with a self-sustaining financial model
- the precedent of long and costly time tables

While challenges do exist, existing Ecovillages and other sustainable communities offer precedents that help to **brainstorm possibilities for successful development** at the Willow Reserve site:

- develop the area as a mixed-use green space acting as a gateway to the Willow Reserve, creating economic stability in the area while making the site's natural assets accessible
- conceive of the ecovillage as a catalyst to stimulate further sustainable development in the neighborhood
- use a community garden to bring the residents together in the care of the garden, and provide both financial stability and neighborhood outreach through a farmer's market at the site
- promote public transit (and fewer parking spaces) by acquiring an HOURCAR hub (a car-sharing already in use in the Twin Cities), bike rental, and/or providing residents with monthly transit passes
- consider future residents—owner-occupied homes contribute to a stable community, but other options could include college students and public servants who, despite their low income and transient status, may be interested in participating in a sustainable community project
- Robert Gilman, who originally defined the ecovillage term, offers these guidelines:
    - recognize it will be a journey
    - develop a vision- and keep developing it
    - build relationships and bonding
    - make the "whole-system" challenge explicit
    - get help to become more self-reliant
    - develop clear procedures
    - maintain balance—sustainably
    - be open and honest

While many aspects of community development are social and economic, this paper also explored options for the **physical design of a sustainable and verdant development**:

- sustainable design principles
    - LEED- Neighborhood Development criteria
    - passive design (insulation, locate building and windows with sun patterns in mind)
    - active design (geothermal/district heating, wind power, radiant heating)
- financial stability
    - reducing long term costs with initial energy and maintenance-saving investments
    - revolving loan fund allows individuals to invest in the development (which banks may avoid)
    - support income such as a community garden
- flexible construction
    - allow for future changes in occupancy or use by designing easily-adaptable structures
    - for change without renovation, plan functionally neutral rooms and incorporate universal design which accommodates people across age and disabilities
- prefabricated construction-*standardized elements built off-site for assembly on-site, allowing decreased construction time, less waste, and higher quality due to the efficiencies of factory construction*
    - kit homes *deliver the basic structural elements of a house to the site for assembly by contractor or homeowner—includes pre-cut, timber frame, domes, log cabins, and steel framing*
    - panelized homes *are composed of prefabricated roof, floor, and wall panels, often with insulation, wiring, plumbing, and ductwork sandwiched inside—includes prefabricated 2x4 walls, Structurally Insulated Panels (SIPs), Flat Pak house (while SIP construction provides many benefits for construction speed, structural strength, and ecological design, there are issues with regards to reuse and flexibility that need to be worked out)*
    - modular homes *contain two are more factory-built volumetric module (while the time, cost, and quality benefits are similar to panelized systems, modular stud wall construction is more precise and more flexible, though less airtight)*
    - manufactured homes*, known as mobile homes if constructed before strict HUD codes in 1976, are a complete package and require little or no on-site labor*

Ecovillages and sustainable communities thrive when they are connected to larger social and cultural institutions. **Several possibilities exist for collaboration**:

- greenlight charette *utilize team of students and professional volunteers to brainstorm, through words, models, and drawings, additional possibilities for the Willow Reserve*
- architecture department *through studio class, students could design and build a small structure such as a bus stop, greenhouse, or garden area*
- geofluids department *collaborate on grant-funded experimental district heating*
- solar house student team *consult for Minnesota-specific sustainable residential construction*
- center for sustainable building research
- agriculture department *contact for assistance in Minnesota urban farming*

A development that balances communal, economic, and physical elements in the creation of a more sustainable community has many precedents and is possible at Sparc's Willow Reserve site.

ECOVILLAGE LITERATURE REVIEW

The following section examines the use of the term "ecovillage" in scholarly books and journals, magazine and newspaper articles, and internet sources. There is no one consistent spelling of the term—in fact, multiple spellings are commonly found within the same publication. Common alternative spellings are eco-village, EcoVillage, or Eco Village. "Ecovillage" will be used throughout this paper as it is a frequently used spelling and implies a synthesis of two words into a new concept. While ecovillage does not appear in any of its forms in a standard dictionary, the word is composed of the prefix eco, and the base word village, defined as:

> *A rural settlement that is much smaller than a town. Sometimes used to refer to local centres within a city, that were previously separate villages.* (Park, 2007)

Village in this case implies both an identity-rich neighborhood somewhat separate from the larger community, and a place with rural values. While "eco" as a prefix comes from the Greek oikos, meaning "home" or "dwelling," the prefix in this and similar contexts is short for "ecological," defined as:

> *Relating to the interrelationships between organisms and their environment* (Park, 2007).

The word "ecovillage" merges these two terms into a singular concept for community development. A complete analysis of the origin, definition, and use of this new expression follows.

There has been a proliferation in the past couple decades of words prefixed with "eco." Ecologist Mohan Wali argues that great caution should be taken when using such words, as these "*terms have been coined to convey the impression that environmental problems can be solved just as easily as they have arisen…that it is possible to 'have a technological fix for every technological fault'*" (Wali, 1995). The author goes on to note that, while many negative prefixes exist (non, anti, etc.), few others aside from the letter *a* have a positive or neutral connotation. Therefore, "eco" has become a preferred prefix to add a positive connotation, environmental or otherwise, to a wide variety of words. This leads to a good deal of confusion as to what "eco" really means, and "*every effort must be made to make the transmission of a message forthright and without obfuscation*" (Wali, 1995). If Sparc chooses to adopt the term "ecovillage" to describe their development, a concerted effort must be made to define the term clearly in promotions and justify its use with substantial ecologically-minded practices. Examining the history and best practice in the area of ecovillage development is a good start.

DEVELOPMENT OF THE CONCEPT AND TERM

Ecovillages have evolved to provide an economically viable alternative concept for living in response to declining modern society (Sizemore, 2004). As a response to both the social and ecological problems brought about by our contemporary culture of individualism, the ecovillage solution has social, environmental, and economic components. In fact, it is this "*marriage of environmental concern and community building that distinguishes the ecovillage movement from other intentional communities, both historical and contemporary"* (Kirby, 2003). The list of historic intentional communities is long: Puritan settlements in the New World; the Permaculture development of Crystal Waters in Australia; hippie communes such as "The Farm" in Tennessee; Danish co-housing begun in the 1960s; German peace activists who set up "ecovillages" next to nuclear power plants which they were protesting (Dawson); Arcosanti in the Arizona desert, a prototypical city experiment in the "archology" of Paolo Soleri; anthroposophical Camphill communities (based on the spiritual philosophy originated by Rudolph Steiner in the early 1900s); and even traditional villages still in existence (but threatened by industrialized development) in sub-Saharan Africa. Some communes, formed primarily to develop community or spiritual life, later evolved into ecovillages in a response to the developing ecological crisis (Sizemore, 2004). Several of these communities and many others adopted the label "ecovillage"—without a clear, global definition of what that meant. While each of these precedents had an emphasis on community life, environmental harmony, or spirituality, none was a synthesis of the three. Additionally, they existed primarily in isolated, rural locations scattered across the globe with limited contact among each other.

It was not until around 1990 that the world-wide development of ecovillages was studied, defined, and promoted. Under strong guidance from Hidur and Ross Jackson, the charitable organization Gaia Trust was founded in Denmark in 1987 in order to support a more sustainable and spiritual future, especially through the development of ecovillages. The trust was funded by Gaiacorp, a foreign currency management and advisory firm started in 1987. It was based on research and software Ross had developed, which he donated while retaining 10% of shares of the new corporation. The company was sold off in 2000 as planned to provide more capital for project support (R. Jackson & Jackson, 2004). In 1991, Gaia Trust commissioned Robert and Diane Gilman to study ecovillages around the world. While they found many examples of ecologically-focused communities, none completely embodied the ecovillage dream as Gaia envisioned it (See the following section for Gilman's ecovillage definition resulting from this study)

Gaia Trust held several meetings and conferences which led to the creation in 1994 of the Global Ecovillage Network (GEN), which allows communication between many small, experimental communities. As the internet was gaining in popularity, its website (gen.ecovillage.org/), became an important tool for sharing resources and created a database of ecovillages (Sizemore, 2004). In 1996, GEN entered the global stage after participating in the Habitat II conference in Istanbul (R. Jackson & Jackson, 2004). GEN is divided into three regional affiliates; GEN Europe and Africa, GEN Oceania, and the EcoVillage Network of the Americas (ENA). The organization is currently involved in connecting and supporting existing ecovillages and promoting the ecovillage concept worldwide. The Gaia Trust supported GEN financially until

mid-2003, when the position of International Secretariat was dissolved and management was distributed to the three affiliates, with the ENA, for example, taking on the responsibilities of the website. GEN continues to operate, but with decentralized funding and at a more localized level than during its height in the late 1990s. As of August 2009, there were 449 ecovillages listed in GEN's database, 47 in urban areas worldwide, and 108 in the US. However, the number of active ecovillages is probably less—a fair number of the examined links led to ecovillages that did not exist. Additionally, most articles were dated 2004 or earlier. While the website and GEN itself are still useful tools for connecting communities and sharing resources on a worldwide scale, the most effective means of interaction between communities may still be an old-fashioned web of personal connections.

Perhaps the most important aspect of the global ecovillage movement is its commitment to education. Gaia University, with roots in GEN, offers degrees as well as workshops on ecovillage-related topics (www.gaiauniversity.org/english/index.php). Living Routes allows college students the chance to study abroad while living in an ecovillage in a program accredited by the University of Massachusetts Amherst (www.livingroutes.org/). The Farm in Tennessee hosts classes and workshops on permaculture design (www.thefarm.org/general/), and in Illinois Midwest Permaculture hosts workshops and seminars on permaculture as well (www.midwestpermaculture.com/). The key to spreading the ecovillage movement is educating others to alternate ways of life as well as allowing them the chance to experience ecovillage life in action.

TOWARD AN ECOVILLAGE DEFINITION

The wide variety of ecovillages causes there to be many models and definitions of the term. While most ecovillages are found in rural areas, a growing trend is the urban ecovillage. Ecovillages range in size from self-sufficient communities of hundreds or even thousands to small cooperatives of 2-6 people housed in a single family dwelling, although the ideal size for a cohesive community is 50-150 (Hill & Dunbar, 2003). The communities can be urban, suburban, or rural, and incorporate green buildings, local food production, solar energy, carpooling, and community building efforts (Groc, 2008). In the past, ecovillages were typically formed by future residents through a consensus-building process, but now developer-driven projects are allowing the ecovillage model to reach more mainstream audiences (Bundale, 2004).

The first formal, universal definition of an ecovillage was offered by Robert Gilman in 1991 in a report commissioned by the Gaia Trust and summarized for *In Context* magazine. While quasi-ecovillages did exist, there was no formal definition. Gilman defined the fledgling concept of an ecovillage as follows:

> *-Human scale, usually thought of as somewhere between 50 and 500 members, but with exceptions*
> *-A full featured settlement, in which the major functions of life—food, provision, manufacture, leisure, social life and commerce—are all present in balanced proportions*
> *-Human activities harmlessly integrated into the natural world*
> *-Supportive of healthy human development*
> *-Successfully able to continue into the indefinite future* (Gilman, 1991a)

Gillman notes that ecovillages are a new way of life different from the traditional village, which tends to be patriarchic, not particularly healthy for humans or the earth, and not full-featured. He also included a diagram (Figure 1) illustrating the challenges of creating a successful ecovillage. In it, the whole project rests on the "glue," a shared value or vision that holds the community together. This supports the economic and governance (community) challenges, which in turn support the visible requirements of an ecovillage: the built environment and relationship to nature. Gilman writes that the challenge of the whole system "*is to get an honest sense of the scope of the undertaking and then develop an approach that allows the community to develop at a sustainable pace*" (Gilman, 1991a). This challenge integrates sustainability into the whole process, not just the final product.

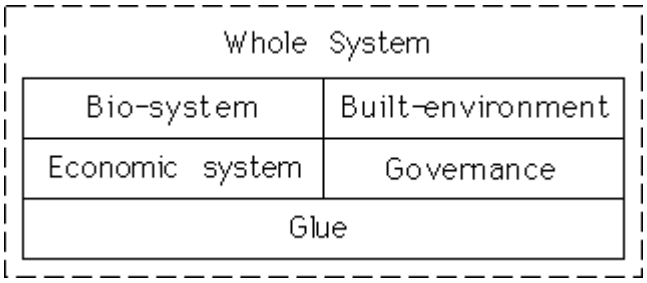

Figure 1. Gilman's Ecovillage diagram.

One of the most popular definition of an ecovillage is posted on the GEN website:

> *Ecovillages are urban or rural communities of people, who strive to integrate a supportive social environment with a low-impact way of life. To achieve this, they integrate various aspects of ecological design, permaculture, ecological building, green production, alternative energy, community building practices, and much more* (Global Ecovillage Network, 2009).

This definition is commonly accepted and cited by member ecovillages. Use of a common definition helps to globally unite this locally-based movement. GEN originally wanted to copyright the name "ecovillage," reserving it only for settlements which met their high, well-rounded standards for sustainability and community, but the word proved too generic to copyright (R. Jackson & Jackson, 2004). While the word can have a narrow ecological definition, the social and spiritual aspects of ecovillages were important to the founders of GEN, who chose the concept over "permaculture" because of its more clearly defined integration of these aspects (H. Jackson, 1998).

Each ecovillage usually adds their own twist to the definition, highlighting the values most fundamental to that particular community. The six-person 611 EcoVillage in Oakland defined an ecovillage as

> *The intersection of community and sustainability. In an ecovillage, people live together intentionally and not because they just need a place to live. In a society marked by separateness, isolation, and individuality, an intentional community can restore some of the qualities inherent in most human societies* (Antonioli, n.d.).

This definition highlights the opportunity for human connection that 611 offers. In a study done in Japan, the term refers to a village on a larger, economically self-sustaining scale, referring to an agricultural village that is financially viable while remaining as close to a natural state as possible.

> *An eco-village is defined as a self-supporting area in which, with the support of environmental conservation technologies, both a productive economy and the*

maintenance of semi-natural environmental systems can be realized (Takeuchi, Namiki, & Tanaka, 1998).

The concept and practice of a village supporting itself through sustainable agricultural techniques was pioneered in Japan by Masanobu Fukuoka and his "One-Straw Revolution."

While certain communities place more emphasis on one area than others, ecovillage definitions usually include components of ecology, economics, and community. The community aspect of the ecovillage model is difficult to quantify and define. However, the importance of community in the ecovillage is made clear when one understands that most ecovillages form as a critique and cure for contemporary individualist society with its ecological and economic injustices. Ecovillages primarily seek to create connections, among people and between humans and the natural world. In an article for the Journal of Environmental Psychology examining the Eco-Village at Ithaca, Andy Kirby suggests there are five key connective elements inherent to individuals in that community:

-a spiritual connection with the wild landscape
-connection with community
-connection with a cultivated landscape of benign human activity
-sense of personal integration
-connection through time/intergenerational stability (Kirby, 2003).

This process is "f*acilitated both by the physical design of the ecovillage, and by the practices that the community has adopted*" (Kirby, 2003), such as sharing communal meals and carpooling. These basic rituals "*keep people in touch in a natural and informal way*" (Kirby, 2003). Perhaps the most important definition of an ecovillage is a place that promotes connection outside the individual.

The concept and the definition of an ecovillage has continued to evolve since Gilman coined the term nearly twenty years ago. Recently, Gilman suggested that it would now be appropriate to "*let go of 'ecovillage' as a defining concept and replace it with the term 'sustainable living in community'*" (Arkin, 2005). While the ecovillage concept is useful for thinking about and discussing possibilities for sustainable communities, perhaps there are other accessible words, such as those that Gilman suggests, that can describe the ideas present in the ecovillage model with less ambiguity.

THE URBAN ECOVILLAGE

The term ecovillage has been applied to urban communities with growing frequency. While rural ecovillages are often isolated communities cut off from mainstream society and contributing to the problem of suburban sprawl, urban ecovillages attack the problem of troubled cities by establishing themselves in problem low-income areas where ecologically-minded communities are needed most. An offshoot of GEN, the Urban Ecovillage Network was "*formed to promote public demonstrations of lower-impact living that re-invent the way we live on our planet*" (Kriegman, 2003). Early participants in the UEN included the Los Angeles Eco-Village, EcoCity Cleveland, Detroit Ecovillage, Cincinnati Ecovillage, H.O.M.E. in Alberta, and Mairreya Ecovillage in Eugene, Oregon. The purpose of UEN includes increasing communication between urban ecovillages, organizing gatherings, promoting speeches and articles about the urban ecovillage

concept, and generally raising public awareness. Their website, urban.ecovillage.org, provides links to several relevant articles and books. Unfortunately, many sections of the site are "under construction," and the most recent conference was in fall 2007. It is unclear whether the UEN is still an active organization.

A commonly acknowledged strength of the urban ecovillage is that the strategy strikes at the heart of urban degradation, not fleeing to a Utopia in the suburbs or rural areas. Some urban ecovillages, particularly in the developing world, aim no less than for the eradication of poverty through development of sustainable infrastructure, i.e. sanitation, waste, energy, building materials, and food (Swilling & Annecke, 2006). In addition to the physical improvement of urban areas, an ecovillage in a city increases its visibility, aiding its ability to act as a catalyst for positive change:

> *When 'regular' people are able to visit and interact with ecovillages…in dense, highly accessible urban neighborhoods like the one described above, far greater numbers of people can consider shifting to a more sustainable lifestyle…Most need tangible urban examples to imagine how they, too, could live more sustainably, and without leaving home. This is reason enough to support urban ecovillages, but even more so if you are called to be an agent of social change and you love the vitality, diversity, and sensuality of cities* (Arkin, 2005).

Additionally, urban ecovillages help to curb the escalating struggle to "keep up with the Joneses" that leads to overconsumption:

> *These demonstration neighborhoods will become shining beacons to help people here and internationally steer past the American Dream. Urban ecovillages will be powerful manifestations of alternative, affordable, comfortable, high-quality living* (Kriegman, 2003).

The hope is that when others see how fulfilling life can be without the need for massive consumption of resources, they will be inspired to change their habits as well. Most importantly, they will have a model of how to do so.

Urban ecovillages have several advantages and disadvantages when compared to rural ecovillages. According to Jim Schenk, co-founder of the Enright Ridge Ecovillage, their drawbacks include streets which are already laid out with preference for car traffic, little control over who chooses to move to the neighborhood, and older houses built without awareness of sustainable construction (Schenk, 2005). On the positive side, however, the houses already exist and therefore do not require harvesting of new materials and use of raw land, retrofitting existing buildings costs less than building from scratch, residents can focus on improving their present situation instead of arguing over neighborhood layouts and alternative systems, and the neighborhood is established close to job opportunities. Most importantly, as most of the world's population moves into cities, it is important to make urban centers healthy and life-sustaining instead of fleeing metropolitan problems. And while ecovillages are criticized for taking up greenfield land, contributing to sprawl, and being mostly middle-class, a solution to this issue is for urban ecovillages to instead develop "brownfields in the urban core" with subsidized units for lower-income households (Bundale, 2004).

Just like the traditional ecovillage, every urban ecovillage is different. However, many sustainable elements have been successfully replicated and are a good starting point for

developing a new urban ecovillage. Lois Arkin of the LA Eco-Village has written about the features of an ideal urban ecovillage (Arkin, 2005), paraphrased below. Most of these ideas have been applied, while some still wait to be implemented:

- growing and selling fresh produce
- greenhouse and abundance of plant life including fruit trees
- greywater cleaning tank
- use of solar panels
- wind generators
- green building materials
- garden mulch
- composting toilets
- plaques describing all of these green features to visitors
- schoolchildren working in the gardens
- electric vehicles
- bus stops
- an interesting and rich street life
- most people seem to know each other
- meetings, events, and educational workshops
- support and encouragement from local government
- residents that work nearby or in the neighborhood
- connection to outside media, entertainment, and educational institutions

ECOVILLAGE CASE STUDIES

The best way to learn about the model of an urban ecovillage is to examine the development and practices of such communities already in existence. Following are three case studies of urban ecovillages in the United States that are relevant to Sparc's interests. Other sustainable communities which do not use the ecovillage label are profiled in later sections. Additionally, EcoCity Cleveland is creating several ecovillage-type developments that are worth examining, but the scale of the entire project was too large to include in this paper as a case study directly related to Sparc's interests in developing their small site. Their projects are nonetheless interesting, and more information can be found at www.ecocitycleveland.org/ ecologicaldesign/ecovillage/intro_ecovillage.html.

LOS ANGELES ECO-VILLAGE

The Los Angeles Eco-Village is the most mature of the urban ecovillages. It was established in 1992 in response to the crisis of the race riots, and its continuing mission is to provide stability and support to the diverse, low to mid-income neighborhood which surrounds it. In the two-block 11-acre area, comprised of 500 neighbors, about 75 participate in ecovillage activities. At the core of the ecovillage is a 35-member intentional community who have moved with purpose into the blighted neighborhood. They occupy some of the 48 apartment units in two buildings the organization owns and manages the property through consensus decision making. They are now in the process of retrofitting the buildings to be more eco-friendly. Guests are also welcome to stay in the apartments to experience ecovillage life, and non-participating residents

occupy the remainder of the units. The Cooperative Resources and Services Project sponsors the ecovillage. A nonprofit 501.c.3 community development organization, it was founded in 1980 by Lois Arkin (also the main figure behind the development of the LA Eco-Village) as a resource center for small ecological cooperative communities. It continues to provide workshops, tours, and educational outreach related to sustainable communities.

The project is privately funded and has no bank loans, borrowing from like-minded individuals through the Ecological Revolving Loan Fund (ELF). Private lenders decide the loan amount, interest rate, and length of loan. They contribute to ELF, and profits from the apartments are placed into ELF and used to pay back the loans. While the lenders were at first national and international, they are increasingly more local, and even ecovillagers themselves. To date, the fund has borrowed over $1 million and steadily paid it back, principally through income from apartment rental.

The heart of the LA Eco-Village is the intentional community. Weekly community dinners often invite guests such as political candidates to liven the discussions and raise awareness of current issues. Most ecovillagers are politically active and socially engaged. About half do not own cars, as many bike and use the plentiful nearby public transit options. Households without cars receive a $20 discount on rent. Ecovillagers hope that their presence in the community will demonstrate a way of life "*that is so beautiful and inspiring, others will be encouraged to begin or strengthen mindful living in their own neighborhoods*" (Arkin & Morrison, n.d. & Pollock, 2009).

ENRIGHT ECOVILLAGE (FORMERLY PRICE-HILL), CINCINNATI

This ecovillage, occupying a half-mile dead-end street surrounded by 200 acres of woods in the low to medium income neighborhood of Price-Hill near downtown Cincinnati, is the most recent embodiment of a green dream for the area. The effort towards ecological redevelopment of the neighborhood began in 1978 with the founding of Imago by Enright residents Jim and Eileen Schenk. A nonprofit education organization offering workshops and conferences about sustainability, they also operate an outdoor Earth center for school children on eight acres of woods. The year 1993 saw a group of 15 Price Hill residents, who believed the best place to house the human population was in urban centers, gathering to "*develop a model for revitalizing a transitioning neighborhood into an ecological neighborhood*" (Schenk, 2005). They promoted the idea though brochures, a video, and community presentations, and in 1998 received a six-year grant to develop an ecovillage in the 50-block Seminary Square within Price Hill.

While the neighborhood was improved through block clubs, street trees, park and building improvements, and eco-rehabilitations, a full-fledged ecovillage never came to fruition. A study concluded the following reasons for the project's failure:

- *The project began in the most deteriorated area of Price Hill*
- *There was a huge influx of relatively transient renters into the neighborhood during this time.*
- *The 50-block area was too large.*
- *The project began without a large group of residents in the area being committed to the ecovillage concept* (Schenk, 2005).

The group then decided to work towards an urban ecovillage on Enright avenue. Several factors led to the Enright area's greater success as an ecovillage:

- Extensive neighboring woods
- 25 of the 90 households on the street had pre-existing ecological values
- The housing was stable, moderately priced, and mostly owner-occupied
- Most households recycle
- 2/3 of houses had already been insulated through an Imago program, and many had installed energy-efficient windows and appliances
- Two bus lines run near the street
- A solid business district is nearby, not to mention downtown Cincinnati

Subsequently, 19 residents met and used an Appreciative Inquiry assessment to discover what they liked about their street and what they would like to see more of. They divided the outcomes into four sections (improved image, walking trail, shared meals, and better adult/child relationships) and worked in committees to improve these areas. They developed a brochure, marked the entrance to the street with "Enright Ridge" planters, and wrote a mission statement:

> *Enright Ridge Eco-Village, a community inspiring Earth-friendly living, nurtures an intimate and prosperous neighborhood within its uniquely forested urban setting in Price Hill in Cincinnati, Ohio.*

A series of four community meetings drew an average of 15 people each, but still there was a desire to engage the larger 90-household area. Consequently, a Treasure Mapping process was held on a Saturday, involving a cart filled with art supplies which traveled to 10 stops along the street. Residents were called out of their homes to make a collage to express their desires for the neighborhood. This collage became a "*jumping-off point*" for further developing this "*retrofit urban ecovillage.*" This ecovillage was only possible because "*residents spoke up about their desire to create a supportive community that actively advocates for their own safety as well as the safety of the Earth*" (Reidel, 2008). The experience of the Enright Ridge Ecovillage demonstrates that it is the support and hard work of a community of neighbors that is crucial to the success of an ecovillage.

HAWTHORNE ECOVILLAGE, MINNEAPOLIS

The Hawthorne Ecovillage exists in a four-block area Southeast of Lowry and Lyndale in North Minneapolis. Project for Pride in Living is the key developer, in partnership with the Hawthorne Community Council. While still in the "forming" stage, it provides a close-to-home example of the genesis of an urban retrofit ecovillage. Information from A. Loosen (personal communication, July 17, 2009).

The process of formation began in 2006, when the area was identified as a "cluster" project area by the Northside Home Fund. This designation indicated a high number of vacant and boarded homes and a commitment by the fund to buy and renovate those properties and return them to owner-occupancy. As resources focused on the area to tear down or rehabilitate crime-ridden properties, the cluster has seen a dramatic reduction in crime since 2007. Neighbors are also involved in an informal watch of the area and alert authorities of suspicious activity.

Meetings with the community indicated a desire to distinguish this cluster from the other five in North Minneapolis, and the idea of creating an "ecovillage" emerged. While it has not yet been clearly defined what it means to be an ecovillage, the consensus was to work towards developing a generally eco-friendly area. The project intends to achieve LEED for Neighborhood Development certification (LEED-ND) and LEED for Homes Gold. Kim Bretheim at LHB developed a master plan for the four-block area, and since that time the foreclosure crisis led to the abandonment and demolition of many properties. Plans for a development of new single-family homes were put on hold, and instead the focus is on enhancing the existing housing stock. The Minnesota Urban and Rural Homesteading Program is providing support for the eco-rehabilitation of several homes in the ecovillage for sale to owner-occupants, and energy audits and retrofit assistance for existing owners are in the pipeline. The next step in the project is to develop a mixed-use development on Lowry and Lyndale for commercial and residential use. PPL has had discussions with tenKsolar, a Bloomington company, about solar installations for the project, and the building is intended to be a landmark for the area that passersby can look to as an example of sustainable design.

In this long-term project with is estimated to cost $30 million, funding is an important concern. The Home Depot Foundation is a major contributor, distributing funds towards actual construction costs, with progress updates held every year. Additional funding for the project comes from the Family Housing Fund and the Northside Housing Fund, with whom meetings are held every two months. Other supporters include Minneapolis Community Planning and Economic Development, Hennepin County, Twin Cities LISC, Minneapolis Neighborhood Revitalization Program, Minnesota Housing Finance Agency, and the Mississippi Watershed Management Organization. Low-income housing tax credits are a critical funding source as well. Habitat for Humanity and Urban Homeworks may be involved with future development. In 2008, Tree Trust partnered with PPL to create a tree nursery using trees left over from their programs. Any Hawthorne resident can take a tree for their yard, with the goal being to green the streets with plant life. PPL has also considered developing a community garden on a vacant lot, but there are already three in the area and another might over saturate the demand.

Kevin Gulden at PPL is working to develop the project along with Shalaunda Holmes, who has a background in landscape architecture and a degree in planning from the Humphrey Institute. In 2008, Abbie Loosen was hired as a Rose Fellow, a national program which places an architecture graduate with an affordable housing development agency. She is working on the Ecovillage, among other projects. In a recent interview, she mentioned that it would be helpful to be more specific earlier on about what an ecovillage actually entails. Abbie is now hosting a series of community meetings and conducting research to further define what an ecovillage would look like in the Hawthorne cluster. As the project progresses, the development and the people and organizations involved will continue to be a helpful resource and precedent for Sparc.

BENEFITS AND CHALLENGES OF THE ECOVILLAGE MODEL

A major objective in the development of Ecovillages is to be more environmentally sustainable than other development methods. However, few studies have been done to determine if the ecovillage model meets this goal. Available methods for analysis of "sustainability" include

measuring the project against established criteria such as LEED, examining the project's conservation of natural ecosystems, analyzing ecosystem indicators to see what effect the development has on the environment, or calculating the project's Ecological Footprint.

Ecological Footprint (EF) measures the "*total area of productive land and water ecosystems*" required to support the consumption and waste absorption of a population (Moos, Whitfield, Johnson, & Andrey, 2006). While the size of a *building* footprint describes the actual land the foundation takes up, Ecological Footprint describes the amount of land required to support a building, person, or community. For example, the CO2 emitted by the heating of a particular building might require an acre of forest to offset it. EF calculations quantify the environmental costs of resources people and their habitats require to sustain themselves. They can be used to describe footprints as basic as the construction and maintenance of a building, and can include both the consumption of the inhabitants of that building as well as the footprint of the surrounding community. Compared with the other methods, Ecological Footprint calculation has the advantage of producing a numerical result which takes multiple ecological factors into consideration. There is also a goal: as of 2000, the earth can offer an EF of 4.7 acres per person.

A 2006 study (Moos et al., 2006) uses the Ecological Footprint method to study the importance of community design by assessing the comparative footprints of three types of development on the property, the current site of the Ithaca EcoVillage. These include the existing ecovillage (Figure 2); Rose Hill, a previously-planned upper-scale suburb (Figure 3); and New Uxbridge, an imagined New Urbanist development (Figure 4). This study provides valuable analysis of the ecological qualities of an existing ecovillage relative to suburban and New Urbanist developments.

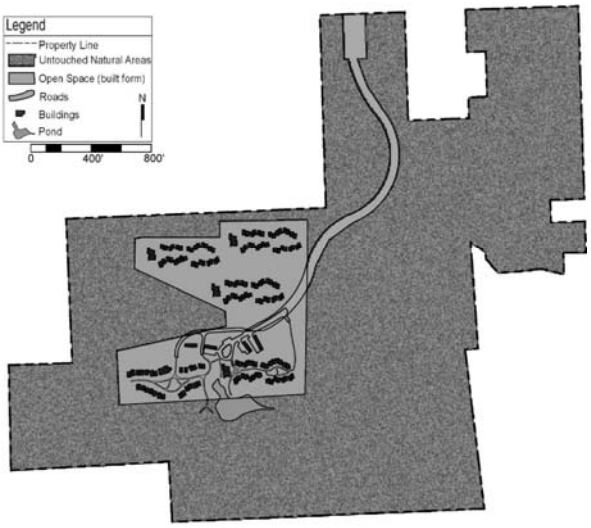

Figure 2. EcoVillage at Ithaca.

Figure 3. Rose Hill.

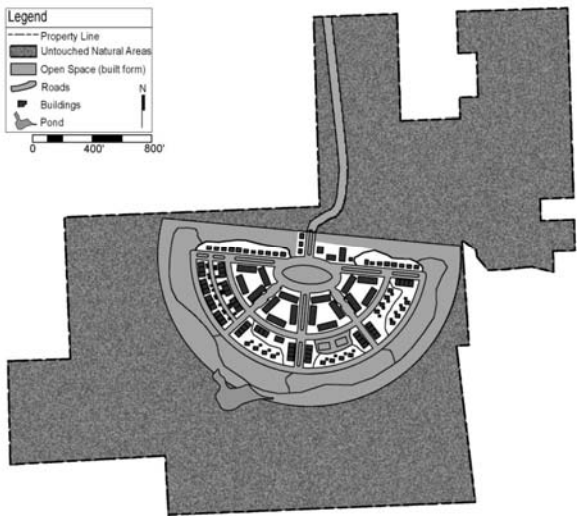

Figure 4. New Uxbridge.

The authors of the study suggest that EF, rather than strict design guidelines, could be used to encourage the construction of ecological developments. Publishing comparative EF results could "*educate stakeholders on the environmental implications of different developments*" (Moos et al., 2006). Calculating EF values for future developments may be a useful tool for quantifying environmental costs while working towards an EF of 4.7, as Sparc hopes to generate interest in investment in sustainable building. BedZED, a housing development in England discussed in the section on Sustainable Design, set just such a goal of allowing each resident to have an EF of 4.7.

Development of the EcoVillage at Ithaca began in 1991 on a rural, wooded site just outside Ithaca, NY. There are currently two communities of 30 households each, clustered near each other and sharing common spaces, and a new development will bring the total to 90 homes. The community employs many of the key principles of an ecovillage, including cohousing, density of development, preservation of natural lands, engagement with the larger community, permaculture, and consensus building as a form of self-government.

The study showed that high density of units did result in a lower Ecological Footprint for the structures (Figure 5). However, it also revealed that a possibly more important factor than the physical design is the social behavior patterns fostered by the ecovillage (Moos et al., 2006). While the EF calculations for the hypothetical New Urbanist and suburban developments used the average consumption patterns for the area, actual consumption data was used in the case of the EcoVillage at Ithaca. The physical form of the EcoVillage and New Urbanist development have relatively equal Ecological Footprints, but when consumption is factored in this similarity quickly dissipates. The study concludes:

	EcoVillage	New Urbanist	Suburban
Housing Units	150	150	150
Net Density (units/acre)	49.6	10.5	1.2
% of Open Built Space	67%	53%	15%
Undeveloped Natural Land	85%	73%	0%
Average EF/person for structures	1.2	1.7	3.3
Average total EF/person	10.5	17.0	18.6

Figure 5. Comparative EF Data.

> *The findings show that denser designs in this study reduced the EF by more than one acre per person as compared to estate-style housing, due to differences in housing size, private lawns and parking. However, the study indicates that consumption, not built form, contributes most to the overall footprint; therefore, the link between design and behavior is of critical importance. The experiences at EcoVillage at Ithaca suggest that physical design may be a catalyst or facilitator of some changes in consumption, especially as they relate to utilities and possibly also to transportation, but no overall conclusion on the interaction between design and behavior can be drawn from this study* (Moos et al., 2006).

It is clear that a sustainable development must involve not only density, solar panels, and good insulation, but residents who practice sustainable acts such as conservation and recycling. This aspect of sustainable development is more difficult to plan and enact.

While a community of dedicated residents is what makes an ecovillage work, it is also the greatest challenge of development. Ecovillages require a commitment to a community and a sustainable lifestyle in ways that the modern suburb does not (but perhaps a village of the past did). Several authors note this is a difficult aspect of the ecovillage model, stating that "*whereas integrating into the built form the technology for living in an environmentally sustainable manner is relatively easy, the task of creating the kind of community that can experience and demonstrate a socially sustainable lifestyle has proven to be a much greater challenge*" (Kirby, 2003). It takes work to test new kinds of ecologically friendly technology, but it is more difficult to test and predict the behavior of human beings.

Those interested in ecovillages may be dissuaded by the perceived intensity of community life. However, in the EcoVillage at Ithaca at least, "*The level of community involvement that each resident experiences is purely an individual decision*" (Kirby, 2003). Communal meals are optional, and while dwellings are spaced close together, a sense of privacy inside the home remains. Participation is always a choice, never a demand. Interestingly, most Ithaca residents were more interested in moving to the village to foster social community than they were for environmental reasons (Moos et al., 2006). Choosing to live in an ecovillage is not a sacrifice of personal freedom, but a exchange of individualism for a higher quality of life in harmony with others. One ecovillage advocate notes that giving up a large yard, selfishness, and materiality seen as a right in our culture is well worth it. "*As the grandchild of immigrants, I understand the pervasiveness of the American Dream. However, in my life the call of community has won out against the lure of consumerism*" (Kriegman, 2003). Still, life in an ecovillage may not be a good fit for everyone, and potential residents often go through a trial period of attending dinners and meetings to see if they would be happy in an ecovillage environment.

The challenges of the ecovillage model include difficulty forming 'community', a lifestyle dramatically different from that of the average American, lengthy and costly development, and a level of sustainability that, while assumed, has rarely been assessed (Moos et al., 2006). However, the payoffs in terms of reduced EF, a life in connection with neighbors and nature, and a sustainable community are also great. These are issues that must be taken into consideration as Sparc formulates its development plans.

Many involved in the ecovillage movement offer guidelines intended to define their particular approach and aid others in their development of sustainable communities. In the example of the Lynedoch Eco-Village in South Africa (Swilling & Annecke, 2006), their social sustainability is a balance of:

- good governance
- maintaining a proper social mix
- developing the next generation through a child-centered approach.

Other guidelines take the form of practical instructions. In a letter to "Communities" magazine (Swilling & Annecke, 2006), Tom Hammer, who has experience in intentional community development, suggests to:

- find the typical demographic for potential cohousers in the area
- hold interest meetings that focus on relationships rather than the agenda
- host social events
- start a website

Around the time he published his ecovillage definition, Robert Gilman offered these eight steps towards ecovillage development, a mix of philosophy and practicality (Gilman, 1991b):

- *Recognize it will be a journey - and enjoy it!*
- *Develop a vision - and keep developing it*
- *Build relationships and bonding*
- *Make the whole-system challenge explicit*
- *Get help - to become more self-reliant*
- *Develop clear procedures*
- *Maintain balance – sustainably*
- *Be open and honest*

This is a small sample of the many guidelines that are written to help organizations like Sparc develop their own sustainable communities. Perhaps it would be helpful for Sparc to compile their own set of guidelines in order to clearly lay out their objectives and development plan in order to provide a focus for future work on the project.

CONSIDERING AN ECOVILLAGE AT THE WILLOW RESERVE

The 3-acre site that Sparc owns south of the Willow Reserve already has several qualities necessary for a successful ecovillage as profiled above. These include access to public transportation, a location in a low-to-middle income community, proximity to downtown and places of employment, nearness to a nature reserve (as in Enright Ridge), and good visibility in an urban neighborhood where the possibility exists to become a catalyst for greater change. The question left to be answered is if support exists within the neighborhood for a community-based sustainable way of life that a true ecovillage requires.

However, even if Sparc determines that the ecovillage model is not an appropriate match for its Willow Reserve development, there is a wide range to how Sparc could adopt aspects of urban ecovillages to fit its needs. On the end of the spectrum, Sparc could develop a self-sustaining community with its own social structure, waste management, agriculture, and energy production. On the other end would be a housing development that is sustainably built and has sustainable infrastructure in place, such as greywater management and groundsource heating and cooling. The development could be coordinated by Sparc and then handed over to a management company or sold to future residents.

Here are a few practical recommendations for Sparc as they brainstorm sustainable options for their development. If a community garden is constructed, residents could have the option of subsidizing their rent through planting, watering, and harvesting the crops. This would make rent more affordable as well as ensure upkeep of the garden. Produce could be sold in a market within the development, generating traffic to the site and giving the larger community a reason to engage new residents. Fewer parking spaces may be able to be negotiated due to proximity of public transit. This was successfully achieved in the Noji Gardens development, an affordable housing development in Seattle. Additionally, a collaboration with MetroTransit could be explored which would provide unlimited bus rides at a discounted rate (currently $76/month) (First Community Housing, 2009). This fee could be included with rent to encourage transit use. While businesses can currently provide transit cards to their employees, no program exists at

the moment for housing developments (a precedent is in place in the Bay Area). Additionally, an HOURCAR hub could be located in the area, allowing residents access to a car for trips to places inaccessible by bus. HOURCAR is currently looking for partners to establish new hubs throughout the Twin Cities and has funds through a McKnight grant to subsidize these costs. Additionally, members of the Housing Committee proposed options for community space ranging from a woodshop or car garage to an arts and crafts room hosting spinning wheels, painting space, spray booths, or a kiln.

Regardless of the level of integration of ecovillage methodology Sparc chooses, the presence of a successful sustainable community near the Willow Reserve is sure to have a positive impact on the surrounding community. Jonathan Dawson, President of GEN, compares the presence of an ecovillage in a local economy to a yogurt culture, "*seeking to inoculate their surrounding bioregions with the ferment of sustainability*" (Dawson, 2006). He lists three things that are happening to make this a reality:

-the need for ecovillages to identify themselves as belonging and of service to something larger than themselves alone
-the creation of alliances with partners with which they can work bioregionally
-developing ties specifically of economic mutuality

An important lesson to learn from urban ecovillages is not just standards for design, systems, and organization, but a spirit of reaching out to a wider community. This is perhaps the key factor that differentiates urban ecovillages from social experiments of the past. "*Urban eco-villages are not a quest for utopian settlements, but rather a practical, modest way of achieving livable and healthy neighborhoods*" (Sizemore, 2004). The real question is not how Sparc can replicate an urban ecovillage on a 3-acre lot, but how Sparc can build quality homes that are better for the residents and the environment, so the development is self-sustaining and prized by the larger community.

THE GREATER COMMUNITY

An ecovillage, and particularly an urban ecovillage, plays a special role in the greater community, serving as a demonstration center for sustainable neighborhood development and a stimulus for change. Making planning and design decisions that integrate the new development into the existing neighborhood can help insure its success and viability.

GOOD NEIGHBORS

Most ecovillages begin through the initiative of future residents. Although Sparc would be the developer in this case, it would be wise to keep community members in mind throughout the design process–in both the existing neighborhood and the residents the development hopes to attract.

"*The success of the neighborhood is not only the number of units built and people who live there, but the way in which people experience a healthy, engaging and intriguing community*" (Neal, 2003).

COMMUNITY SURVEY

Sparc has already engaged the existing community, holding two public meetings in April 2009 and conducting a survey on the preferred use of the Willow Reserve property (Figures 6 & 7). While the survey indicated a preference to use the area as green space, reading the written comments paints a picture of a neighborhood anxious about the introduction of more housing, low-income housing in particular, into an area riddled with foreclosures and vacant housing. One respondent stated, "*No more affordable housing! Too much rental already, hit hard with foreclosures. Build up Rice Street and get rid of vacancies*." Residents are concerned with falling home values and don't want to see development that will cause values to fall even further. "*With better than half of the North End already rental the last thing we need is more. The value of our owner occupied properties has already suffered enough. We need to return the neighborhoods back into what they once were-- "NEIGHBOR" HOODS!*" This statement notes the importance of neighbors—not transient renters—who are invested in their community. The development of the area according to an ecovillage model, where residents are committed to sustainably caring for the land and neighborhood, may appease such fears.

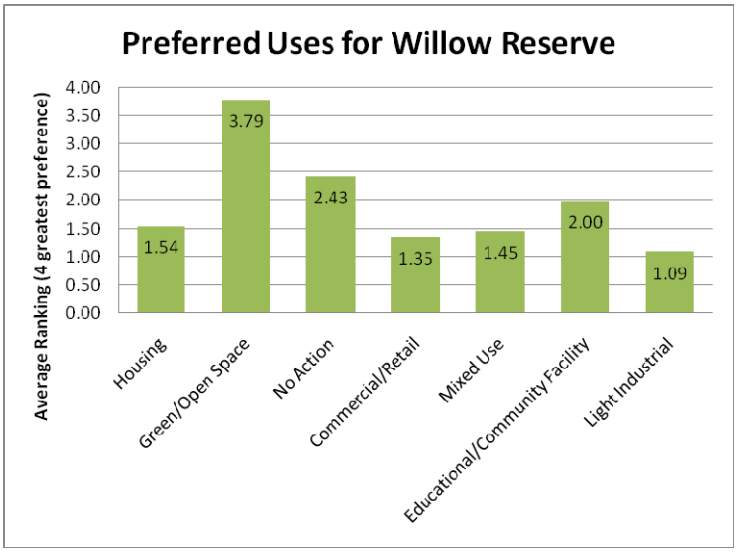

Figure 6.

A major concern is the loss of access to the Willow Reserve and natural land. The presence of nature in a crowded city is indeed a positive asset to a community. However, developing the land at the Willow Reserve does not have to mean the loss of nature. This development should be a "gateway" to the Willow Reserve in that it welcomes visitors, protects the reserve from loitering and street traffic, and mediates access. Additionally, the development itself can be designed to be an asset to the natural environment. Itsuko Hasegawa believes that "*any new building must make up for the topography and space that is altered because of its introduction and help create a new nature in the place of the one that used to be there*" (Hasegawa, 1991). Architecture is "Another Nature" that humans create, and it has the opportunity to improve the natural environment just as a flower beautifies a forest floor. The addition of an element into nature does not necessitate the destruction of nature. The challenge, then, is to not only minimize the damage new housing creates, but to actually create a more vibrant natural environment on the site through the development of the land. Examples could include planting a garden to share with the community, giving a place of prominence in the design to existing trees, or planting rooftop gardens—essentially lifting up the existing green space and letting it remain on top of the structure.

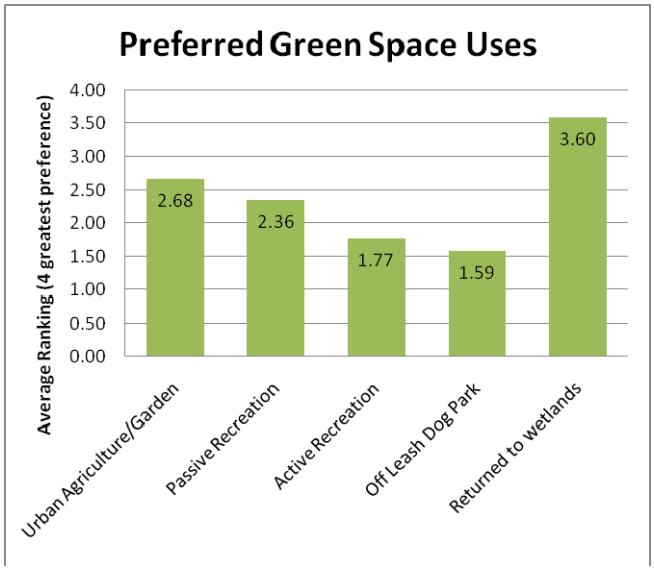

Figure 7.

Some residents are in support of developing housing, noting, "*it would be important to have some development, preferably housing on the site. If the Sparc-owned space totally becomes open green space, there is more likelihood there will be more crimes due to no eyes/ears on the street.*" This comment recognizes the power of the presence of concerned neighbors so crucial to the importance of urban ecovillages. Others would simply like to see new housing that makes home ownership affordable. "*St. Paul has a shortage of affordable, new housing for people within 80% AMI. I would love to see detached SF homes priced affordably. It would be an added benefit to have a play area within the area of these affordable new homes.*" Whatever development plan Sparc chooses, a supportive community can only add to its chances for success. A model sustainable community on the Willow Reserve site could act as a stimulus for neighborhood pride and future growth. If an ecovillage model is chosen, current residents worried about falling values should be comforted knowing that "*residents of ecovillages and cohousing communities tend to be well-educated, middle-class individuals and families*" (Bundale, 2004). These individuals and families make up the second community relevant to the Willow Reserve development: the future inhabitants.

FUTURE RESIDENTS

It is also important to consider potential residents of the Willow Reserve site. While owner-occupied homes are one possibility for a stable community, another is a transient renter group that nonetheless would be committed to the neighborhood. College students or young legislative interns at the nearby state capitol are a renter population that may be interested in participating in a sustainable community development project. Another model is Urban Homeworks, which rents housing in struggling Twin Cities neighborhoods to students and recent graduates who volunteer in the community and meet with each other weekly. Additionally, marketing the development to participants in the HERO program is a possibility. A mix of owner-occupied and rental housing is also a possibility. At Oakridge Village (2006) in Britain, a neighborhood of 300 units contains 50% affordable housing, but units appear identical from the exterior (Schneider, 2007). Possible owners in the development could be recruited at the Home and Garden show or other "green" events. Future residents could be attracted through the inclusion of a community asset which addresses an unfilled niche such as a woodshop, music practice rooms, or computer lab. Sparc could also develop a design and programming which brings existing residents and ecovillage residents together in a natural way, such as at a bus stop or shop in the new building.

NEIGHBORHOOD DESIGN

Residents are integral to a community's success, but design methods can help foster neighborhood relationships as well as lead to the desirability and sustainability of a neighborhood in the long run.

LEED FOR NEIGHBORHOOD DEVELOPMENT

A new program, LEED for Neighborhood Development, provides guidelines and certification for developing sustainable neighborhoods. It was created in partnership with the U.S. Green Building Council, the Congress for New Urbanism, and the Natural Resources Defense Council. Registration for the post-pilot program is scheduled to open in late 2009, pending USGBC member ballot approval. In St. Louis Park, the development at Excelsior & Grand was a participant in the pilot program and received LEED-ND certification May 11th, 2009. It is frequently noted as an excellent local example of sustainable neighborhood design. Library Green in Moorhead was the only other MN participant. There is no minimum development size—one pilot project was .17 acres, while several were less than five acres.

Like LEED for Buildings, the pilot program is set up as a checklist that allows developments to earn points for certain features to qualify for Certification (40), Silver (50), Gold (60), or Platinum (80-106) ranking. The **Smart Location & Linkage** category offers a potential 30 points for issues such as decreased automobile dependence and housing and jobs proximity; **Neighborhood Pattern & Design** (39 points) encourages compact development and diverse use, affordable housing for sale and rent, and even local food production and community outreach; **Green Construction & Technology** (31) awards points for LEED certified buildings, storm water management, and waste management. Additionally, 5 points are available for innovation in design & process. See the complete pilot checklist and rating system draft at www.usgbc.org/DisplayPage.aspx?CMSPageID=148.

Following LEED-ND recommendations may lead to improved health for residents. The Center for Disease Control (CDC) found that many of the program's features, promoting walkable neighborhoods, local food production, and green open spaces, "encourage the development of healthy, active neighborhoods" (National Center for Environmental Health: Division of Emergency and Environmental Health Services, 2009). While not scientifically proven, it is believed that healthy, active neighborhoods assist in developing healthy people.

VISUAL RELATIONSHIP

The visual curb appeal of the new development also affects how it fits into the community. Should it be design to fit in, or bring a new look to the community which promotes positive change? Currently, the North End is generally comprised of single-family worker housing from the early 20th Century without many decorative frills (Nelson, 2006). However, the area directly around the Willow Reserve is comprised of only a few single-family dwellings, with several two-story brick apartment buildings, a strip mall, and a vacant restaurant. These newer structures should not be ignored when considering the project's overall aesthetic relationship to the area. Sparc can opt to design the housing in accord with turn of the century homes, or to incorporate the flat roofs and rectangularity of the newer buildings into the design.

COMMUNITY ALLIANCES

Partnerships and alliances help to both strengthen an ecovillage and allow it to act as a catalyst for change in the community. For example, the EcoVillage at Ithaca has partnerships with Cornell University and Ithaca College (Dawson, 2006). Similar possibilities exist here in the Twin Cities.

UNIVERSITY OF MINNESOTA

As a major land-grant research university with a commitment to community connections, UMN is an excellent source of collaborative potential in numerous fields.

GREENLIGHT

- greenlight.cdes.umn.edu/

Host a design charette in January. The common format is a Friday night presentation and a Saturday work session from 9-4 with final presentations at the end of the event. Past participants have included a green retrofit for Brave New Workshop and HERC. If Greenlight is not interested in a partnership, Architecture for Humanity MN may be interested in hosting a charette.

ARCHITECTURE DEPARTMENT

- arch.design.umn.edu/

Offer a Design/Build course in May or Summer term. Projects could include Bus Shelters, Greenhouses, or gathering space. At Noji Gardens, an affordable housing development in Seattle, University of Washington architecture and urban planning students designed and built a trellis and benches, transforming a cul-de-sac into a public gathering space. Additionally, the University of Virginia (www.ecomod.virginia.edu/index2.php) and Auburn University (www.cadc.auburn.edu/soa/design-habitat/) have both independently held design/build studios to design modern prefab affordable residences in partnership with local non-profits.

CENTER FOR SUSTAINABLE BUILDING RESEARCH

- www.csbr.umn.edu/

This department's mission is to "transform the regional built environment to provide for the ecological, economic, and social needs of the present without compromising those of the future" through research, outreach, and education, and as such is a natural fit to collaborate with Sparc on this project. Particularly relevant is their Minnesota Sustainable Housing Initiative, sponsored by the McKnight Foundation.

GEOFLUIDS DEPARTMENT

- talc.geo.umn.edu/orgs/geofluids/

Collaborate with Geofluids department for **experimental geothermal district heating**. A strong possibility exists for grant funding opportunities. Contact Jimmy Randolph, student member of the research team, at rando035@umn.edu.

COLLEGE OF FOOD, AGRICULTURE, AND NATURAL RESOURCE SCIENCE

- www.cfans.umn.edu/

Since landscape and agriculture is as important to sustainable communities as their architecture, collaboration with this college would be extremely appropriate. They may be able to assist with anything from helping to plan a community garden using Minnesota-specific techniques to performing an economic impact analysis of the project.

SOLAR HOUSE TEAM

- www.solardecathlon.umn.edu/

A solar powered house was recently designed and built for a national competition in D.C. This home could be looked at as a **design precedent for the Minnesota climate**. Additionally, they may be looking for a place to locate the building after the competition.

STUDENT HOUSING

There is a need for additional housing options for students. The proximity of the site to the 3 bus line makes it an easy 15-20 min ride to the East Bank. Sparc could also look into housing students from other nearby colleges or young legislative assistants at the State Capitol who have **low incomes but may be interested in participating in a sustainable community**.

COMMUNITY AGRICULTURE

In sustainable communities, small-scale agriculture often plays a large role. Urban gardens are a good use of otherwise vacant land, they provide fresh produce for residents, and give neighbors a natural place to gather and interact. Examples include Growing Power in Wisconsin, numerous community gardens throughout the Cities, and several local organizations.

COMMUNITY DESIGN CENTER OF MINNESOTA

- www.comdesignctrmn.org/

This organization operates gardening programs on vacant urban land, run in the summer by local youth interns. There is a focus on youth development and nutritional and entrepreneurial education.

YOUTH FARM & MARKET PROJECT

- www.youthfarm.net/

Similar to the Community Design Center, this organization operates gardens on vacant land in Minneapolis and St. Paul.

EXISTING FARMERS' MARKET

Instead of growing food directly at the Willow Reserve site before buildings are constructed (which may provoke community resistance if the gardens need to be demolished later), Sparc could rent the land to an existing farmer. Besides nutritional and economic benefits, this would attract people to the site and could be used in the future for promotion of the new development.

SUSTAINABLE DESIGN

The premise of an ecovillage involves its economic, social, and environmental sustainability. However, Sparc also hoped this report would address issues of sustainable design not particularly tied to the ecovillage model. They were particularly interested in basic guidelines for incorporating sustainable building design and the use of prefabrication (sustainable construction and maintenance), designs that were flexible enough to adapt to changing inhabitants (sustainable use), as well as financial sustainability (sustainable economy). These topics, which are the focus of this report due to this researcher's areas of study, are just a few of the many elements of "sustainability." Simply, however, sustainability implies design that meets the needs of the present while being able to sustain itself into the indefinite future—without harming the prospects of future generations. It would be worthwhile for Sparc to explore aspects of sustainable design beyond those in this limited and basic report, for example use of fossil fuels and other energy sources, land use and landscape architecture, or programs to reduce consumption and promote health of residents. There are many levels of sustainability as well—it is sustainable to recycle a glass jar, but it is even more sustainable to reuse it as a drinking cup instead of buying a new one. In this planning phase, it is important to define ways in which the Willow Reserve project can be sustainable in the fullest sense of the term.

"GREEN" BUILDING TECHNIQUES

Building methods are a good, straightforward place to begin discussing sustainable design. They can be divided into two categories—passive and active. Passive design includes systems that:

- *use no purchased energy (no electricity, natural gas)*
- *use components that are part of another system (windows, floors)*
- *are closely integrated into the overall building fabric (not tacked on)*

Active design includes any systems that is not passive, such as solar panels and light-dimming sensors (Kwok & Grondzik, 2007). Sparc specified that they would like to see sustainable design integrated into the building design and not simply tacked on as an afterthought. It is easier to achieve this with passive design since it is an actual component of the building structure, and these features are often virtually maintenance-free. However, active systems can also become a beautiful feature integrated into the construction and integral to the residential community.

ACTIVE SYSTEMS

Active systems are what people usually think of when envisioning sustainable technology. Though they can tend to be pricey and require energy to maintain, they do provide opportunities when reading by candlelight is not an option. Some include:

- solar panels
- water treatment system
- geothermal systems (sometimes considered passive)
- low-energy lighting
- occupancy sensors
- heat recovery system

PASSIVE SYSTEMS

While these building techniques tend to be less expensive and easier to integrate, adding all might not be the best option. An experienced designer can help to choose a mix of approaches that complement each other and are appropriate to the short term and long term budget:

- good insulation
- thermal mass—a mass of material like concrete designed to absorb heat from the sun during the day and release it slowly over night
- rainwater harvesting
- rain gardens
- green roof
- restricting hard landscaping—to allow water filtration into groundwater
- sun shades—to block summer sun yet let in winter sun

DESIGN CHOICES BEYOND BUILDING STRUCTURE

Some aspects of sustainable design go beyond building construction. Location is one of these. The Willow Reserve's location on a bus route in an urban setting is an important aspect of its sustainability, as is its location near jobs and green space. Additionally, the actions of the residents has a major impact on the sustainability of the overall community. The study of the Ecovillage at Ithaca discussed earlier demonstrates this. Composting, separation of garbage, and recycling all play a part, as does reducing electricity and fossil fuel consumption. Some aspects of design can help shape this behavior, such as easy access to compost sites, but the type of community is highly influential. For example, "*the cohousing model is itself environmentally sensitive because it promotes shared resources among households*" (Crosbie, 1995). Shared resources leads to a reduction in needed resources, leading in turn to greater sustainability. Factors beyond pure architecture should be taken into account when planning for sustainable development.

OTHER RESOURCES

While LEED is a popular tool for understanding green design criteria and certifying buildings (www.usgbc.org/), several other systems exist to help builders, developers, and users understand green construction methods and lifestyles. Here are some of the best:

- **NAHB Green Building Program** www.nahbgreen.org/index.aspx
- **Passive House** www.passivehouse.us/passiveHouse/PHIUSHome.html
- **Sustainable Buildings 2030** www.csbr.umn.edu/research/sb2030.html

<u>Minnesota Specific Sites</u>

- **MN Green Communities** www.mngreencommunities.org/
- **MN Sustainable Building Guidelines** www.msdg.umn.edu/
- **MN Greenstar** www.mngreenstar.org/
- **MN Sustainable Housing Initiative** www.mnshi.umn.edu/kb/guidelines/gcm/gc.html
- **MN Green Affordable Housing Guide** www.greenhousing.umn.edu/

SUSTAINABLY DESIGNED HOUSING: BEDZED

Figure 8. View of BedZED showing personal garden space, southern-facing windows, and solar panels on roofs among other green features.

The Beddington Zero Energy Development, known as BedZED, is a 2002 housing development in England which is one of the best examples of a sustainable community integrating technology and encouraging personal behavior change. It was developed on an area of just 3.5 acres on an existing brownfield site, yet it can support 82 units and space for offices, studios, shops, and communal facilities while still allowing buildings to receive sunlight. BedZED does not identify itself as an "ecovillage" and places less of an emphasis on the social sustainability at the heart of most ecovillages; therefore, it is not included in the ecovillage section. However, the project does identify goals in areas of environmental, social, and economic concern. Even though residents were not involved in the planning stage in BedZED as in many ecovillages, a sense of community has developed in the area, with many residents citing "community" as one of the reasons they moved to the area (R. Jackson, 2004).

BedZED's goal was to enable each resident to have an ecological footprint (EF) of just 4.7 acres, the number of productive acres on earth divided by the total population at the time. Compare that to average UK resident's EF of 15.3. If every person on earth had an ecological footprint of 4.7, the planet would be truly sustainable. To accomplish, many technologies, programs, and design strategies were employed. Here are some of the highlights (Kwok & Grondzik, 2007):

- Planning for maximized solar gain in winter
- Natural ventilation
- Triple-glazed argon-filled windows
- Daylighting
- 107 kW of photovoltaics provide 11% of energy with a pay-back of 6.5 years
- Water conservation
- Green roofs and personal gardens
- On-site blackwater treatment
- Sustainable materials
- Photovoltaic-powered electric cars
- Recycling- construction waste and that of residents

Post-occupancy monitoring is an important aspect of the project, and has found that the development has an 88% reduction in space heating, 50% reduction in water use, 65% reduction in fossil fuel car mileage, and 25% reduction in electricity over the average UK development, exceeding most target reductions. While the developer incurred added building costs, they are

able to rent the apartments at an average of 15% more than the typical unit due to the attractiveness of the reduction of utility cost, the desired community aspect, or perhaps the airy and healthy design of the complex. BedZED demonstrates that a sustainable community can be developed on a small site while remaining relatively affordable, attractive to the general public, and also foster a sense of camaraderie and inspire sustainable habits in its residents. More information is available at www.peabody.org.uk/media-centre/factsheets/bedzed.aspx.

WILLOW RESERVE OPTIONS

While there are numerous options to use sustainable design in Sparc's future development, some features seem particularly appropriate for the Willow Reserve Site:

- **Rooftop Greenhouse:** As Sparc mentioned they would prefer gabled roofs, perhaps greenhouses with a pitched roof could be placed on top of the flat roof surface. This would accomplish several objectives at once—retain the greenspace the buildings displaced, help the modern modular squareness fit into the esthetic of the neighborhood, provide a place to grow produce year-round, and offer a beautiful lush space with a great view of the neighborhood.
- **Interior Greenspace:** If two modular buildings are connected by a transparent roof and side walls, this could create an interior greenspace without too many additional materials. This feature is especially nice for Minnesota winters and would provide a common space for casual interaction between neighbors despite the cold. This area could also be used for composting, a greenhouse, and educational programs. It could potentially be open to the general public as well.
- **Plenum Floor:** An ingenious method for locating mechanical systems is the plenum floor. It is a space (a few inches to a foot) between the solid base floor and a raised, panelized floor. It can contain ventilation, electrical, and communication systems. The panels allow for easy access for system maintenance, but they also allow for future flexibility as additional outlets, air vents, and with relative ease. The downtown Minneapolis library uses this system.
- **Stilts:** Because Sparc's lot is even with the road level and slopes down towards the Willow Reserve, it may make sense to place the buildings on pylons so that the buildings are entered on-grade at street level but contain a space underneath on the back for a tuck-under garage. This would decrease the need for excavation.

FLEXIBILITY

One aspect of design that makes buildings sustainable into the indefinite future is their ability to adapt to a variety of uses. This can be labeled "flexibility." The opposite of the "planned obsolescence" all too common in our consumerist society, designing for reuse from the beginning is especially important in housing, where inhabitants move in and out, families grow, shrink again as children move away, and age brings new demands for accessible design. To some extent, the less a building needs to be extensively remodeled or demolished in order to accommodate change, the more sustainable it becomes. An excellent book on the topic, *Flexible Housing*, is the product of comprehensive research by Tatjana Schneider and Jeremy Till. They note that changing needs involve these social aspects as well as updates in technology, and changing demographics and economics of a neighborhood—nineteenth century warehouses, Victorian homes, and office buildings of the 1960s are good examples of structures that are well-suited for alteration (Schneider, 2007).

> The beauty of flexible housing is that if one follows through the principles, and combines them with a response to climate change, one almost inevitably arrives at a sustainable solution that integrates the complete range of sustainable issues; however, the green rhetoric is a quiet one that eschews the superficial gestures of some sustainable architecture. Flexible housing potentially exceeds the accepted definition of sustainability… inasmuch as it is not about the avoidance of future compromise but the encouragement of coming change (Schneider, 2007).

Tatjana and Schneider make the distinction between adaptability and flexibility clear; while adaptability allows for different social uses, flexibility also allows for different physical arrangements. An adaptable apartment might have a room that can be used as a dining room, bedroom, or office, but a flexible design may have sliding screens or a fold-down bed to allow for changes in use. The authors show a preference for designs that are adaptable without changes to physical form (and it is usually less expensive to design), but the addition of flexible design to already adaptable schemes is an added bonus. Similar is their categorization of "soft" flexibility (indeterminate- a screen can be placed anywhere in a room) and "hard" flexibility (determinate- a screen slides along only two predetermined tracks).

> "*The hard view can be seen as extending the influence of the architect, and thus becomes part of the wider regime of control that modernity is associated with. Flexibility is provided, but on the architect's terms. In the soft view, flexibility dissolves the control of the architect and hands it over to the user*" (Schneider, 2007).

Hard flexibility is usually driven by advances in technology, a technology which becomes the focus of the housing design and can often overwhelm the human (unpredictable) aspects. To admit that buildings will change over time in unpredictable ways is terrifying for most architects—the challenge is to plan for but not dictate these changes.

DEVELOPMENT OF THE METHOD

The quest for a dynamic architecture is and has been of interests to architects around the world. The second CIAM conference in 1929 (International Conference on Modern Architecture) focused on "The dwelling of minimal size and cost," which naturally produced many propositions for flexible architecture (van Eldonk & Fassbinder, 1990). The Dutch and the Japanese have been particularly interested in the concept.

THE NETHERLANDS

In The Netherlands, the question of flexible architecture has always focused on the home. "*Earlier than elsewhere, the Dutch discovered that houses need not be immovable, rock-solid and monolithic; they should accommodate the movements of life.*"(van Eldonk & Fassbinder, 1990) The earliest cited example was Rietveld's 1925 Schröder house (Figure 9). Here, movable walls in the center of the home could close off centers of activity, such as the bathroom or kitchen, or open up in a wide variety of arrangements to create a large central room.

Figure 9. Schröder House, Rietveld, 1925.

Later, architects paid particular attention to developing flexible social housing apartments. The drastic housing shortage after the end of WWII was the main motivator. An Efficient Housing Construction study group was commissioned to rationalize housing construction in order to increase productivity. The group made several proposals to standardize construction and prefabricate parts to speed assembly. They searched for the "ideal floor plan" and experimented with movable components in order to deliver the best-quality dwelling at the minimum price (Figure 10Figure). Later research furthered standardization of elements,
but the search for a standard floor plan was rejected in favor of process-oriented design tailored to each development. Since the government subsidized worker housing, it wielded great influence over its construction. The group's technical requirements for social housing were documented in "Voorschriften en Wenden," translated "Rules and Suggestions" (van Eldonk & Fassbinder, 1990). This generation focused on standardization and moveable components as the key to flexible dwellings.

Later on, H. Leppla's floor plans did not involve sliding walls. Instead he based his plans on actual research into human use of spaces and designed rooms that could best accommodate a wide

variety of uses (van Eldonk & Fassbinder, 1990). The FORUM group was the next generation, bringing a new wave of thought about flexibility. Herman Hertzberger philosophized that "*the only positive approach to the process of change is a form which presupposes this changeability as a permanent—and therefore essentially static—situation…a form which, without itself changing, can serve any purpose…*" (van Eldonk & Fassbinder, 1990). This was a large departure from earlier architects.

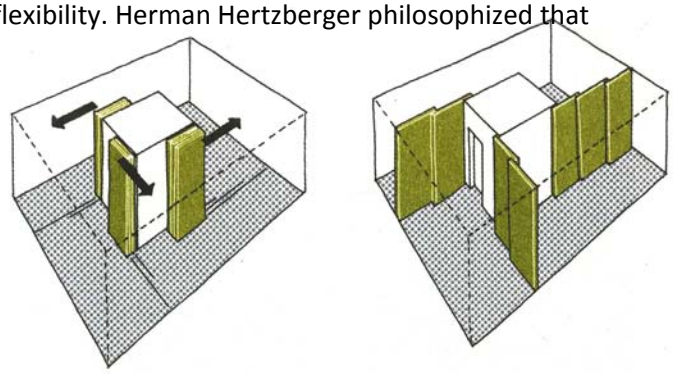

Figure 10. Movable Walls.

Most recently, Habraken envisioned an architecture of flexibility as a building process which fully integrated the end user in the process of design and building, while at the same time pushing the bounds of modern technology in order to "*give both man and machine—the natural relation and mass production, hand in hand—the opportunity for full development*" (van Eldonk & Fassbinder, 1990). Habraken believed that a sustainable building use could only be achieved when the user was integral in the design/build process and full use of modern technology was employed.

JAPAN

On the other side of the world, the Japanese have long been practicing flexibility of use not just in experimental structures, but in everyday life in the common home (Figure 11).

> *An age-old historical example of house-building in which the attempt has been made to give architectural form to dynamism of habitation is the classical Japanese dwelling-house, perhaps the most influential concept of flexibility for modern architecture. In contrast to the Western dwelling-house it has no clearly limited and uniquely defined functional purpose for rooms, but zones which are non-specific as to use, with smooth transitions from one to the other* (van Eldonk & Fassbinder, 1990).

Japanese flexibility involves movable walls and fixtures as well as rooms that are able to accommodate a variety of use. At the most basic level, sliding *shoji* screens allow the house to open up or seal itself according to time of day, the seasons, the weather, and the activities of the house.

Figure 11. Traditional Japanese House.

Perhaps it is no coincidence that Japanese culture has an acute sense for the changes of season and the rituals associated with such natural ebbs and flows.

One aspect of traditional Japanese design that enables such flexibility is a lack of permanent fixtures. Aside from a hearth and *tokonoma*, most rooms contain only *tatami* grass mats on the floor. Furniture such as bedding and tables is kept in a closet and retrieved when needed. Thus the same room can be a bedroom at night and a dining room and living room during the day. Until recently, even Japanese urban forms were fluid. As most buildings were designed to last a maximum of 30 years, the face of the city was ever-changing.

RECENT EXAMPLES

There are many excellent examples of flexible design. In Neuwil (1962-65), an 8-story concrete slab/column building in Switzerland, contains cores of stairs, kitchens, and baths, while the rest of the plan is open. Residents could choose from five types of panels 60 or 90 cm wide, and these were available in a common room in the building to allow for frequent and easy rearrangement. An instruction manual, translated *My apartment is my castle*, provided sample plans for various life changes (Schneider, 2007).

In the Transformable Apartment by Mark Guard Architects, a simple and elegant floorplan is able to transform when beds flip down and walls slide (Figure 12).

Figure 12. The Transformable Apartment, Mark Guard Architects, 1995.

Uberbauung Hellmutstrasse by ADP provides a static flexibility (Figure 13). An extra-wide stair landing permits residents to place chairs or tables outdoors, using the space for both circulation and an outdoor patio. Additionally, walls within the complex are left non-supporting, so the apartments can divided up into single suites or expanded to house multiple families with relative ease.

Figure 13. Uberbauung Hellmutstrasse, ADP, 1991.

Figure 12 Cala Domus, PCKO, 2000.

At Cala Domus by PCKO (Figure 14), a service spine in the middle of the apartment contains all utilities (represented by the shaded strip in plan). This serves not only to consolidate plumbing, HVAC, etc. into one area, but also allows for varieties in floorplan within the same shell and enables future transformation of the space—as long as the bathroom and kitchen are located near the utility spine.

<u>Assessing Flexibility</u>

Building Level

- Can the building accommodate multiple uses, i.e. residential, commercial, office, and retail?
- Can the building/unit/room be adapted by its users?

Unit Level

- Can the unit accommodate a variety of living patterns?
- Can the unit accept a variety of people?

Room Level

- Can the room be used for more than one function?
- Can the room be furnished in a variety of ways?
- Can the room be moved around in more than one way? (Schneider, 2007)

ECOVILLAGE FLEXIBILITY

Beyond the idea of the flexibility of a building is the concept of a "flexible" community, or one that can easily accommodate change without needing to radically reshape itself. The concept of the ecovillage offers this possibility. Designed to accommodate all walks of life (age, profession, etc.), a person can move to an ecovillage and continue to grow with it. In contrast to contemporary society where people move many times during their lives and seldom have strong connections with neighbors, in an ecovillage there is no need to move away when children are born, when the residents experience an increase or decrease in income, or age requires smaller, more accessible housing with greater community support. This is because the communities should contain a wide variety of housing sizes and prices along with a supportive community. Ecovillages are particularly well-suited for aging in place. An older EcoVillage Ithaca resident remarked, "*I know that as I grow even older, I don't want to sit alone in my house and eat my meal. I want to join with other people and talk and find out what is happening*" (Kirby, 2003). It is this supportive environment, combined with a variety of residences, which allows for a flexible community that grows along with its inhabitants instead of forcing them to move on.

PREFABRICATED HOUSING

Although prefabrication is often thought of as simply a construction technique, the method is often associated with the concept of sustainable design. This is because it can lead to a more sustainable construction process, with decreased construction time, less waste of time and materials, improved construction methods and working conditions, and higher quality buildings for more people due to the efficiencies of factory construction (Anderson, 2007). Additionally, prefabrication is often associated with the idea of flexible housing, a "sustainable" concept. While flexible housing lends itself well to incorporating prefabricated components, not all prefabricated housing is designed with flexibility in mind. In the U.S., prefabrication tends to see surges in consumer interest during times of economic uncertainty, demographic change, and technological advances (Ebong, 2005), which makes the construction method particularly relevant to study now.

> *Standard elements are well suited to minimalist architecture, and to the simple, compact forms of low-energy housing, while designs using simple, repeated details go hand in hand with optimization of material quantity. Standardization also generally has benefits for both quality and cost. With the use of standard elements comes the possibility of prefabrication in the factory; elements are produced under controlled conditions, and disposal of debris and waste can be more efficiently dealt with. Less time is spent on site, with a corresponding reduction in noise, dust, site traffic and other environmental nuisances* (Gauzin-Mueller, 2002).

"Prefab" is a complex term, but it is most frequently defined as *the prefabrication of standardized elements off-site for assembly on-site*. Most homes contain prefabricated elements, from windows and doors to light switches and faucets, and could be considered in part prefabricated. However, the term commonly refers to housing where prefabrication involves the design of the home as a whole. There are several types of prefabrication that deliver parts to the job site in increasing degrees of completion. This can be represented by the terms line, plane, and volume. Kit homes (line) involve individual pieces delivered and assembled completely on-site. Panelized homes (plane) are made of prefabricated floors, walls, and/or roof, while modular homes (volume) are made up of several complete volumes. Manufactured homes prefabricate the whole package, requiring little or no on-site work. Further definitions follow, drawing heavily from Michelle Kaufmann's categorizations (Kaufmann, 2009).

KIT

Kit homes deliver the basic structural elements of a house to the site for assembly by contractor or homeowner. Their advantage is their ability to travel on a smaller truck to difficult-to-reach sites. Also known as pre-cut homes, the category includes timber frame houses, domes, log cabins, and steel framing. A popular historic example, selling more than 100,000, was the Sears, Roebuck and Co. mail-order home of the 1900s. A kit of 30,000 parts, from lumber to paint and nails, came with an instruction manual for the price of $2,000. In the late 1940s, the metal-clad Lustron home, subsidized by the government to provide post-WWII housing and develop industrialized methods of housing construction, sold less than for around $10,500 each before declaring bankruptcy. More recently, Brett Zamore has created a shotgun-style cottage kit home for sale on his Zamore Homes website (www.zamorehomes.com/main.html).

Figure15. BoKlok House, IKEA, 1999.

The homes feature green fixtures and finishes while running from $100-$170 a square foot. Zamore accomplishes this by buying in bulk and through the efficiencies of prefabrication, and these kits don't require cranes for installation. Even IKEA offers an inexpensive kit home, the BoKlok (Figure 15), usually constructed in developments in Northern Europe and Britain (www.boklok.com/UK/ About-BoKlok/The-BoKlok-Brand-Values/).

PANELIZED

In panelized construction, roof, floor, and wall panels are prefabricated in a factory. They are a good middle-ground, allowing for more prefabrication than kit homes as well as (usually) easier transportation than modular homes. Insulation, wiring, plumbing, and ductwork are often sandwiched inside. Prefabricated 2x4 walls are one of many examples. Sandwich panel walls were found as early as 1930 in Frank Lloyd Wright's Usonian homes. In Minneapolis, Charlie Lazor has developed the Flat Pak house based on an 8' wall unit (www.flatpakhouse.com/). The components are built in about six months, delivered to the site by semi, and assembled by crane. The price is about $200-$300 a square foot.

In 1950, Wright's student Alden B. Dow was the first to develop a structural panel with an insulating core (Morley, 2000). This was the predecessor to the popular Structurally Insulated Panel (SIP), composed of rigid foam insulation sandwiched between Oriented Strand Board (OSB) and compressed and attached with adhesive. The insulation is most commonly

expandable polystyrene, but can also be made of extruded polystyrene (stronger with a higher R-value but more expensive and dimensionally unstable) or urethane. Additionally, OSB can be replaced with metal, cement board, drywall or fiber-reinforced plastic, but these are not rated as structural panels (see www.sips.org/ for more information).

There are many advantages to SIP construction. Like most prefabricated systems, construction is quicker and more precise than with site-built homes, and complete panels can be delivered to the site flat on a truck. SIPs eliminate many building components—two OSB panels and a piece of foam replace multiple pieces of lumber, insulation, sheathing, and screws. This construction is stronger than stick-built construction and has stood up well to lab tests as well as earthquakes and tornadoes. Whereas insulated stud walls allow heat exchange through 2x4s and other gaps in insulation, SIPs virtually eliminate this "thermal bridging" and therefore have a greater whole-wall R-value (a value taking gaps in insulation into account). The quality insulation leads to a quieter home and greater thermal comfort due to the evenness in the wall's temperature. Finally, the materials used in typical construction are relatively "green"—OSB is made from young-growth farmed trees, and the formation of expandable polystyrene produces no CFCs or HCFCs (Morley, 2000).

However, there are also several disadvantages to SIP construction. For one thing, they make moving an outlet extremely difficult as the walls are completely filled with foam. When a Twin Cities architect was asked at an open house how to add an outlet to his SIP-constructed home, he replied that it was difficult if not impossible to do, but that his design was so perfect in the first place that it would never need additions or alterations. This is far from the principles of flexibility discussed earlier. Additionally, SIPs may not yield as high a cost savings as modular construction. While Michelle Kaufmann constructed her original Glidehouse using SIPs in fourteen months, she was able to construct an identical Glidehouse in a factory and place it at the site in just four months—and for a cost 15 percent less than the SIP home (Kaufmann, 2009). While SIP construction provides many benefits for construction speed, structural strength, and ecological design, there are issues with regards to reuse and flexibility that need to be worked out. However, these are only problems for the load-bearing exterior walls. If a custom baseboard housing wiring is installed, or changes in services are restricted to a "service spine/core" in the center of the building, issues with SIP construction can be minimized. Similarly, solid brick walls have been adapted for reuse in the poster child of reuse, the historic warehouse.

MODULAR

Modular housing combines standardized elements and panels right in the factory to create a volume, shipping two or more modules to the building site. While the modules are being fabricated, the foundation can be put in place on-site by a local contractor, reducing overall construction time. Once the modules are delivered, they are bolted to the foundation and "buttoned-up"—utilities are connected, roofs are installed if they weren't in the factory, and decks and landscaping complete the project. While the time, cost, and quality benefits are similar to panelized systems, modular construction has the added advantage of more precision as more of the building is constructed in a controlled factory environment. Level surfaces and horizontal jigs ensure plumb construction, and the reinforcements needed for transport

increase a modular home's strength. Modular designs, "*assembled from a set of separate and repeated components,*" are not necessarily prefabricated, but they lend themselves well to the building method (Schneider, 2007).

Figure 16. Habitat '67, Moshe Safdie. A popular example of variation within modular apartment building.

Modular construction is extremely popular with contemporary architects, especially those who strive to bring modern architecture with a focus on sustainable design to a large number of consumers. National advocates and designers of modular housing include Alchemy Architects in St. Paul (weehouse.com), rvtr in Canada (rvtr.com), and Michelle Kaufmann Designs in the Bay Area (mkd-arc.com), all profiled below. Kaufmann noted that she didn't originally set out to design modular homes, but the system made the most sense from an ecological and financial standpoint; "*In our vision for a better way to build and a better way to live, we recognized modular as the way to make it happen*" (Kaufmann, 2009). Using methods of prefabrication, modular systems have the ability to offer well-designed homes that are ecologically sustainable and financially affordable for the average consumer.

MANUFACTURED

Manufactured homes, also known as mobile homes, differ from modular homes in that they are constructed on a trailer chassis and follow federal building codes administered by the Department of Housing and Urban Development (HUD). A complete package, they require little or no on-site labor. According to HUD, a mobile home is a temporary dwelling constructed before June 15, 1976, while a "HUD-code manufactured home" is constructed on or after that date and meets higher standards of construction (Burns, 2001). Mobile homes, particularly older temporary-structures-made-permanent-dwelling, are the origin of prefab's negative connotation of the shoddy, cheap construction crowding trailer parks. Proponents of prefabrication, particular modular, try to distance themselves from this model, as modular units are actually built to higher codes than manufactured homes. However, contemporary manufactured housing designed to HUD standards, updated in 1994, can provide an inexpensive and safe housing option. A design studio at the Harvard Graduate School of Design explored the efficiency, design, and expertise in the manufactured home industry, acknowledging that the building typology is typically shunned by architects and government and feared by neighbors as its mobility threatens "*community commitment,*" they note that "*Manufactured housing successfully satisfies real needs. Economies of scale and efficiencies of factory production minimize costs of manufactured housing*" (Burns, 2001).

Noji Gardens is Seattle is an example of a contemporary manufactured housing development with traditional-looking two story designs that fits in well with its upper-class neighborhood (Figure 17). It is very popular because it is designed to look like traditional stick-built construction and fit in with the aesthetic of the neighborhood. Because it is actually a HUD Code building, however, the developer was unable to build apartments with more than two units. Decades earlier in 1970, Oriental Masonic Gardens experimented by stacking mobile homes in a complex pattern, utilizing the single-wide as the "brick of the future."

Figure 17. Noji Gardens, HomeSight, 2002.

DEVELOPMENT OF THE METHOD

Prefabrication is an excellent tool for enabling efficient construction with less waste and better design for the masses. However, the method does not automatically lead to a more flexible design. In fact, all the consumer choice allocated at the beginning of the design process may add details that are too specific to be successfully adapted at a later date. And while layering of building components (structure, insulation, cladding, utilities) is a key component of flexible design, which allows one layer to be switched without the destruction of the entire building, methods of prefabrication (especially SIPs) tend to permanently lock these layers together (Schneider, 2007). Despite of its complications, however, prefabrication remains a method of choice for several respected modern architects who are able to use the method to successful construct low-cost, green, and modern homes:

- **Alchemy Architects:** Known in the prefab world for their weeHouse, this well-respected St. Paul firm practices coast to coast. As the name suggests, the firm hopes to build quality contemporary homes with a small footprint, "instilling value in modern yet efficient living." While the first weeHouse was a small cabin with a budget of $50,000, Alchemy Architects had branched out to not-so-wee-homes which make modern design accessible, dabbled in multi-family development, as well as continued to work in non-modular construction.
- **Kieran & Timberlake:** Their Loblolly House is an excellent example of a prefabricated house that is sustainably designed and is integrated into its unique environment. Planned to complement the loblolly pine forest which surrounds it, the house sits on pylons driven into the earth and an aluminum frame houses floor, wall, and roof pieces as well as modules for elements such as bathrooms. Bolts hold pieces together instead of nails and adhesives, allowing for disassembly and reuse. Many standardized elements are used.
- **Michelle Kaufmann Designs:** When she couldn't find an affordable, green house on the market, Kaufmann designed her own and then started her own firm. While her first home was panelized, she now uses modules and has her own factory, along with hiring experts from several fields. Sustainable design is integral in her firm, and she practices

five EcoPrinciples (smart design, eco-materials, energy efficiency, water conservation, & healthy environment).

- **rvtr:** This Canadian firm of four young architects interested in the idea of prefabrication and choice for the masses. In July, they were awarded the $50,000 Professional Prix de Rome in Architecture which will allow them to study prefab in Japan and Scandinavia in their quest for "*the perfect assembly-line house*" (Mays, 2009). They have designed the North House for the U.S. Department of Energy's Solar Decathlon exhibit in D.C. (where the University of Minnesota will also showcase their Solar House), and its walls function as layers similar to those hikers wear in the outdoors, opening to mild weather and closing to severe, while also collecting energy from the sun.

PREFAB IN JAPAN

Japan has a long history of successfully incorporating prefabrication into their housing production, and "Nowhere has the dream of a factory-produced house made and marketed like an automobile taken root as strongly as in Japan" (Oshima, 2008). Several factors make this possible.

Most homes in Japan currently last for 26-30 years, compared to 55 in the U.S. (Murphy, 2008 & Barlow et al., 2003). This creates a huge demand for new housing. New homes represent 80% of home sales in Japan, about half of which are houses (Barlow et al., 2003). The demand for prefabricated single-family homes comes from their high level of quality, quick production time, and many options for customization—from fixtures and finishes to construction methods and 300 standard designs for elevations and floor plans (Barlow et al., 2003). Sekisui House, the largest, supplies more than 60,000 homes a year, while Misawa Homes builds 30,000 (Barlow et al., 2003). Japan seems not to have a stigma against prefabricated housing. In fact, prefabricated homes in the country are usually for upper-middle class families.

This high level of quality produces longer-lasting homes, which adds to their sustainability factor. Toyota, for example, guarantees their homes for 60 years. The government has considered a tax break for such homes, and they also provide greater protection against earthquakes and typhoons. If the residents become tired of the design before the building wears out, the modules and components can be reused in a different configuration and these "recycled homes" are becoming a part of the prefab market. The U.S. can look to Japan for an example of prefabricated housing technology and marketing that is a popular section of the housing market.

FINANCIAL SUSTAINABILITY

One aspect of the idea of sustainable development is that the projects should also be financially sustainable. This can be accomplished by a combination of reducing initial and long-term costs, designing for a long building lifetime, and using appropriate methods of financing.

REDUCING INITIAL COSTS

Our traditional economic model focuses on the bottom line of construction costs. It is in this category that it is easiest to calculate costs and work to cut spending, and the majority of literature on the topic of financial sustainability focuses on this aspect.

Using prefabrication is one of the easiest ways to cut construction costs as this cuts down on labor time, an expensive element of construction. One source puts the labor cost of stick-built construction at 60-70%, while in a factory labor can be as low as 20% of construction costs, with improved working conditions as well (Hart, 2003). Several non-profit housing organizations, from Enright Ridge Ecovillage to Habitat for Humanity, also employ volunteer labor to save on costs.

Another way to reduce initial costs is to simply build less in the first place. This can mean reducing the building's square footage (as promoted by the weeHouse), but also applies to building in stages. This allows for future expansion as needs of the community grow, corresponding with an increase in capital and a greater knowledge of what the community needs and desires.

FINANCING

Coming up with the financial investment to fund development is a critical piece of financial sustainability. Several sustainable communities use grants to fund the research portion of their development. Many innovative building proposals were funded by federal governments or businesses directly involved in their production in an element of product research.

However, smaller private sources may be easier to obtain. While GEN made a proposal in 1996 to the UN to allocate $100 million for the development of 50 demonstration ecovillages, they were advised to seek funds instead from private foundations and individual governments (R. Jackson & Jackson, 2004). The L.A. Ecovillage funds itself through a program allowing loans from individuals in support of the urban ecovillage cause. Since all ecovillage members are renters, several ecovillage members support the development through investing in loans.

The Enright Ridge ecovillage model has built-in financial stability as most homes are owner-occupied and they assume financial responsibility. However, they are also supported by a non-profit which is able to coordinate the community, operate a newsletter and website and offer grants to homeowners and for community projects.

Alternate development models provide new ways to think about financing. If developers were responsible for not just development but also maintenance and management for an extended

period, this would allow them to invest early and reap the benefits of well-built structures later. Another option is the "buyrent" model developed by Hel Oosten in the Netherlands in which the buyer owns the infill but rents space in the structural shell (Schneider, 2007).This differs from the townhouse or condo model in that the owners could actually add things like a balcony, convert a sunroom into a 4-season living room, or even add a whole addition if it were structurally sound. This method allows buyrenters to invest in their own property while living in a dense environment.

LIFETIME COSTS

While every effort should be made to lower initial construction costs, the continued cost of energy use should be taken into account from the very beginning in a calculation known as lifetime cost. A benefit of sustainable design is that it usually reduces operating costs for buildings, and these savings can be passed onto residents, making a sustainable development an affordable development. Lifetime costs include utilities as well as building maintenance costs.

Ecological design can save money in the long run, especially for the inhabitants who can benefit most from cost savings. This is especially true when the design is applied to a neighborhood scale. One of the three key lessons learned from the Lynedoch Eco-Village development in South Africa was that "*Ecologically designed urban systems and built forms can save households money and can reduce the operating costs of municipal infrastructures (in particular the infrastructures required to deliver water, sanitation, solid waste removal and energy)*" (Swilling & Annecke, 2006). Investments made early on will have future payoffs. A post-occupancy study of BedZED, profiled above (pg 28), revealed that while developers spent a larger initial investment on sustainable features, they more than made up for that cost because of the higher price they were able to receive for units.

A 1971 article predicted that "When use of the computer becomes sufficiently advanced to establish the first single system of ecological accounting, we will know the exact dollar value of all the planning choices under consideration," for example considering the cost between cleaning the atmosphere and the health problems pollution causes. This technology now exists, and it would be wise to take advantage of it. Several computer programs such as EnergyPlus can calculate the resources a building will consume before it is built, allowing adjustments to be made while still in the design phase that can save energy (and money) in the long run.

LONG-TERM VIABILITY AND DESIRABILITY

Creating buildings which people like can improve their likelihood of survival without raising initial costs too significantly (costs which are based more on materials and labor). A 1976 project in Austria calculated that a participatory process, in which future occupants designed their homes in collaboration with architects, made up 1.11% of total project costs. However, the structural system which allowed such flexibility was significantly more expensive than standard practice. (Schneider, 2007) Perhaps such investments pay off in the end. It makes logical sense that a housing design that is flexible would help it last longer, and there is evidence that such housing is more desirable in the real estate market, however little scientific evidence exists to support such hypotheses (Schneider, 2007).

Some argue that the most sustainable building is a beautiful, well-designed building. In a society where goods are discarded long before their useful life is over simply because they are no longer stylish or a better option replaces them, it is important to design buildings that can overcome or adapt to the changing whims of a population. Building-in sustainable technology and encouraging community growth and economic viability through programming and initiatives can also go a long way to ensure that a community supports a building and hence maintains it.

SUMMARY & RECOMMENDATIONS

This paper has explored many precedents that can be used as Sparc plans a sustainable community development at its Willow Reserve property. In summary, the location shows **promise for a thriving urban ecovillage** site for several reasons:

- access to public transportation
- location in a low-to-mid-income community
- close to employment centers
- near nature reserve
- good urban visibility but not too busy

However, **challenges towards development** include:

- finding residents willing to commit themselves to the ecovillage philosophy
- finding the “glue” that holds the community together
- establishing it as a landmark in harmony with the existing neighborhood (people and buildings)
- developing economic sustainability with a self-sustaining financial model
- the precedent of long and costly time tables

While many aspects of community development are social and economic, this paper also explored options for the **physical design of a sustainable and verdant development**:

- sustainable design principles
- flexible construction
- prefabricated construction
- financial stability
- collaboration with outside organizations

A development that balances communal, economic, and physical elements in the creation of a more sustainable community has many precedents and is possible at Sparc’s Willow Reserve site. While this research provides a broad overview on the topic of sustainable community development, Sparc could benefit from further research specifically analyzing the site performed by experts on topics such as storm water management, soil conditions, and economic feasibility.

GLOSSARY

CO-HOUSING

Co-housing is a shared living arrangement between people who are not family members. It can be as simple as several people sharing a house or can involve a cluster of single-family dwellings with shared common spaces such as a large communal kitchen and laundry facilities or gardens and a hot tub. Occasional group meals are an option. Informal self-government such as consensus decision making is often employed. While not all cohousing developments are ecovillages, most ecovillages involve elements of cohousing, with their emphasis on community living encouraging a sustainable lifestyle through the sharing of resources.

ECOHOOD

This is a term referring to an urban eco-retrofit neighborhood in Prescott, AZ, defined more broadly as a "*permaculture retrofit of a mid- to low-income neighborhood with a high potential for ecological sustainability*" (DeFreitas, 2006).

ECOTOWN

Larger than a village, an EcoTown is usually a new suburban development designed with sustainable features. This term has been used recently in Britain to describe a series of planned towns outside London. Unfortunately, in several cases the term “ecotown” has been adopted to avoid government roadblocks for quick development of land which had been rejected for traditional suburbs, and few of these British EcoTowns are coming to fruition.

INTENTIONAL COMMUNITY

A group of people who have chosen to live together with a common purpose, working cooperatively to create a lifestyle that reflects their shared core values. The people may live together on a piece of rural land, in a suburban home, or in an urban neighborhood, and they may share a single residence or live in a cluster of dwellings (Kozeny, 1996).

LIFE CYCLE DESIGN

This method considers the life of a product not from cradle to grave, but from “cradle to cradle,” planning for future reuse. The key is to reuse the product not through downgrading it quality as in using newspapers for pet bedding, but to reuse at the same or higher quality that is able to continue in an indefinite cycle.

PASSIVE HOUSE

The passive house aims to reduce energy consumption by lowering heating costs through airtight and well-insulated construction and supporting heating through solar gain (using sunlight) and heat from inside the building (electronics, people).

PERMACULTURE

The term is a combination of the words "permanent" and "agriculture," implying a culture that is sustainable into perpetuity through appropriate ecological practices. The idea came about in the mid-seventies. Bill Mollison was teaching ecology at the University of Tasmania and, along with his student, David Holmgren, came up with the concept of an "*interdisciplinary earth science with a potential for positive, integrated and global outreach*." *Permaculture One* was published in 1978 (Bang, 2005). Permaculture communities began in Australia and spread to the rest of the world, and the concept is often at the heart of ecovillage design. Classes in permaculture design principles are offered at several ecovillages. Jan Bang offers a through definition:

> *Permaculture is about designing sustainable human settlements. It is a philosophical and practical approach to land-use integrating microclimate, functional plants, animals, soils, water management and human needs into intricately connected, highly productive systems. It presents an approach to designing environments that have the diversity, stability and resilience of natural ecosystems. It seeks to regenerate damaged land and preserve environments which are still intact* (Bang, 2005).

SUSTAINABLE DEVELOPMENT

Defined as "*development which meets the needs of the present without compromising the ability of future generations to meet their own need*" (World Commission on Environment and Development, 1987), the concept was first introduced in a report produced by the World Commission on Environment and Development, chaired by then Norwegian prime minister, Gro Harlem Brundtland. Recognizing the equality between generations and classes of people, "*Sustainable development requires meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life*" (World Commission on Environment and Development, 1987). The document "*emphasized that global environmental problems are rooted to a large extent in the impoverishment of the greater part of the world's population*" (Gauzin-Mueller, 2002). The report was discussed at the 42nd UN congress in 1987. The 1996 report from the US President's Council on Sustainable Development served to further elevate issues of sustainable development. A simple definition especially relevant for ecovillage construction is that "*sustainable development is about determining a level of consumption that lies within the capacity of our natural systems to replenish resources and absorb waste*" (Moos et al., 2006).

URBAN VILLAGE

The term Urban Village is used primarily in Great Britain, and is essentially a New Urbanist philosophy. It is defined by the Canadian Oxford Dictionary as "a small self-contained district or community within a city or town, with residential housing, shops, and services within walking distance." The term is promoted by Prince Charles due to his desire for traditionally planned developments. He discusses the term in his introduction to the book *Urban Villages*:

This was an oxymoron I suppose, but a concept that nevertheless conjures a vision of neighborhood, of conviviality and character, within an urban environment on a far broader scale than the rural village. It is a notion with a universal appeal, reflected in terms like quartier in France, or neighborhood in the United States, suggesting a timeless and human scale to urban development, a form of urban planning that has a fresh relevance in the modern world (Neal, 2003).

WORKS CITED

Anderson, M. (2007). In Anderson P. (Ed.), *Prefab prototypes: site-specific design for offsite construction*. New York: Princeton Architectural Press.

Antonioli, D. (n.d.). *About 611 EcoVillage.* Retrieved 7/1, 2009, from www.611ecovillage.com/.

Arkin, L. (2005). An urban ecovillage of the near future. *Communities,* (129), 44-47.

Arkin, L., & Morrison, L. (n.d.). *The L.A. eco-village: learning to live the changes.* Retrieved July 15, 2009, from www.hopedance.org/archive/issue29/articles/arkin.htm.

Bang, J. M. (2005). *Ecovillages: A practical guide to sustainable communities.* Edinburgh: Floris Books.

Barlow, J., Childerhouse, P., Gann, D., Hong-Ming, S., Naim, M., & Ozaki, R. (2003). Choice and delivery in housebuilding: Lessons from Japan for UK housebuilders. *Building Reserach & Information, 31*(2), 134-145.

Bundale, A. (2004). Greening together. (cover story). *Alternatives Journal, 30*(5), 16-17.

Burns, C. (2001). A manufactured housing studio: Home. *Journal of Architectural Education, 55*(1), 51-57.

Crosbie, M. J. (1995). A maturing green architecture. *Progressive Architecture, 76*(1), 31-34.

Dawson, J. (n.d.). *The ecovillage dream takes shape.* Retrieved 8/1, 2009, from www.gaia.org/mediafiles/gaia/resources/JDawson_EcovillageDream.pdf.

Dawson, J. (2006). How ecovillages can grow sustainable local economies. (cover story). *Communities,* (133), 56-61.

DeFreitas, S. (2006, January/February). Sustainability 2.0: Permaculture activist Andrew Millison on creating the modern "EcoHood" *E/The Environmental Magazine, XVII*.

Ebong, I. (2005). *Kit homes modern*. New York: Collins Design.

First Community Housing. (2009). *Eco pass program for all residents.* Retrieved 8/22, 2009, from www.firsthousing.org/ecopass/.

Gauzin-Mueller, D. (2002). *Sustainable architecture and urbanism: Concepts, technologies, examples.* [Nachhaltigkeit in Architektur und Stadtebau] (K. Purver Trans.). Boston: Birkhauser.

Gilman, R. (1991a). The eco-village challenge: The challenge of developing a community living in balanced harmony - with itself as well as nature - is tough, but attainable *In Context, 29*, 10.

Gilman, R. (1991b, Summer 1991). Guidelines for eco-village development: Eight steps to creating your own sustainable community. *In Context, Living Together 29*, 60.

Global Ecovillage Network. (2009). *What is an ecovillage?* Retrieved 8/1, 2009, from gen.ecovillage.org/.

Groc, I. (2008, January/February). It takes an eco-village: Green communities are spreading--with growing pains *E/The Environmental Magazine, XIX*.

Hart, S. (2003). Prefabrication, the speculative builder's tool, has been discovered by modernist designers. *Architectural Record, 191*(12), 123-126.

Hasegawa, I. (1991). Architecture as another nature. In C. Jencks, & K. Kropf (Eds.), (Second ed., pp. 113). West Sussex, England: Wiley-Academy.

Hill, R. A., & Dunbar, R. I. M. (2003). Social network size in humans. *Human Nature, 14*(1), 53-72. Retrieved from www.liv.ac.uk/evolpsyc/Hill_Dunbar_networks.pdf.

Jackson, H. (1998). What is an ecovillage? *Gaia Trust Education Seminar.* Thy, Denmark.

Jackson, R. (2004). The ecovillage movement. *Permaculture Magazine, 40*.

Jackson, R., & Jackson, H. (2004). Global ecovillage network history 1990-2004. (May) Retrieved from www.gaia.org/mediafiles/gaia/resources/HJackson_GEN-History.pdf.

Kaufmann, M. (2009). In Remick C. (Ed.), *Prefab green*. Layton, UT: Gibbs Smith.

Kirby, A. (2003). Redefining social and environmental relations at the ecovillage at ithaca: A case study. *Journal of Environmental Psychology, 23*(3), 323-332.

Kozeny, G. (1996). *Intentional communities: Lifestyles based on ideals* Retrieved July 1, 2009, from www.ic.org/pnp/cdir/1995/01kozeny.php.

Kriegman, O. (2003). Urban ecovillages: Making our cities green and thriving. *Communities, Fall* (119), 12-15.

Kwok, A. G., & Grondzik, W. T. (2007). *The green studio handbook: Environmental strategies for schematic design*. New York: Elsiver: Architectural Press.

Mays, J. B. (2009, Friday, July 10). The perfect house: A search for the perfect assembly-line house. *The Globe and Mail,* Retrieved from www.theglobeandmail.com/real-estate/a-search-for-the-perfect-assembly-line-house/article1213373/.

Moos, M., Whitfield, J., Johnson, L. C., & Andrey, J. (2006). Does design matter? the ecological footprint as a planning tool at the local level. *Journal of Urban Design, 11*(2), 195-224.

Morley, M. (2000). *Building with structural insulated panels (SIPs) strength and energy efficiency through structural panel construction*. Newtown, CT: Taunton Press.

Murphy, J. (2008, July 2). Toyota throws more weight behind its home unit: Steel-frame houses get renewed push, tie-in to electric cars. *The Wall Street Journal.*

National Center for Environmental Health: Division of Emergency and Environmental Health Services. (2009). *LEED-ND and healthy neighborhoods: An expert panel review* (No. CS124788) Center for Disease Control.

Neal, P. (Ed.). (2003). *Urban villages and the making of communities*. New York: Spoon Press.

Nelson, P. (2006). *Tour Saint Paul: Rice street*. St. Paul, MN: Ideal Printers.

Oshima, K. T. (2008). Postulating the potential of prefab: The case of Japan. In B. Berdoll, P. Christensen, R. Broadhurst & Museum of Modern Art (New York,N.Y.) (Eds.), *Home delivery: Fabricating the modern dwelling* (pp. 32-37). New York: Museum of Modern Art.

Park, Chris. (2007). *A Dictionary of Environment and Conservation*. Oxford University Press, 2007. Retrieved 26 July 2009 from *Oxford Reference Online*. Oxford University Press. University of Minnesota Law Library.

www.oxfordreference.com/views/ENTRY.html?subview=Main&entry=t244.e8698

Pollock, T. (2009, March 3). Los angeles' eco-village. Message posted to metrogreen.blogspot.com/2009/03/los-angeles-eco-village.html.

Reidel, K. (2008, Ecologically speaking communities: Enright ridge urban eco-village *Communities,* , 55-57.

Schenk, J. (2005). A home - grown ecovillage on our street. *Communities,* (129), 52-56.

Schneider, T. (2007). In Till J. (Ed.), *Flexible housing*. Amsterdam: Architectural Press.

Sizemore, S. (2004). *Urban eco-villages as an alternative model to revitalizing urban neighborhoods: The eco-village approach of the seminary square/ price hill eco-village of Cincinnati, Ohio.* Unpublished Master of Community Planning, University of Cincinnati.

Swilling, M., & Annecke, E. (2006). Building sustainable neighbourhoods in South Africa: Learning from the lynedoch case. *Environment and Urbanization, 18*(2), 315-332.

Takeuchi, K., Namiki, Y., & Tanaka, H. (1998). Designing eco-villages for revitalizing Japanese rural areas. *Ecological Engineering, 11*(1-4), 177-197.

Twinn, C. (November 24, 2008). Eco-towns aren't anything without their local communities *The Architects' Journal,* , July 1, 2009. Retrieved from www.architectsjournal.co.uk/the-critics/eco-towns-arent-anything-without-their-local-communities/1931894.article.

van Eldonk, J., & Fassbinder, H. (1990). *Flexible fixation: The paradox of Dutch housing architecture* [(D. R. Welsh Trans.). Assen/Maastricht: Van Gorcum.

Wali, M. K. (1995). ecoVocabulary: A glossary of our times. *Bulletin of the Ecological Society of America, 76*(2), 106-111.

World Commission on Environment and Development. (1987). *Our common future*. New York: Oxford University Press.

FIGURES

Figure 1
Based on diagram in Gilman, 1991a.

Figures 2-5
From Moos et al. 2006. Used with permission from Taylor & Francis.

Figure 8
Photo courtesy of BioRegional. Credit Tom Chance.

Figure 9-13
From Schneider 2007. Used with permission from Elsiver.

Figure 16
Image retrieved from ArtStor, MOMA collection.

Figure 17
Photo courtesy of HomeSight. Credit Krogstad Photography.